WRTU Push Data Protocol

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1. Introduction

This document describes pushing data protocol of WRTU system.

WRTU system has option to push collected data to Cloud periodically. This can be configured in WRTU Client software and saved on WRTU device.

WRTU uses HTTP protocol as the transport layer. It generates HTTP POST request and puts all transmitted data inside single form variable **Data.**

Each data pushing session can be presented as following sequence:

- WRTU system reaches the time when it should send all collected data to remote server
- WRTU system generates HTTP POST request with data saved in **Data** form variable
- Data format can be selectable (for now it is only JSON format)
- WRTU system connects to the remote server ("Cloud") using the configured IP address or domain name
- If connection is successful then WRTU system sends HTTP request and closes the connection

Important Notes

- Regular nanoWiPOM with 3G modem can only connect to IP address and send data as plain HTTP. It doesn't support domain name resolution and HTTPS.
- CG9101-nanoWiPOM with CloudGate modem can send data over HTTPS and connect to domain names.
- WRTU system sends only the data collected since the last successful Push Data session
- After start / reboot WRTU system will send only data collected after start / reboot. It will not send all previously collected data.

Why JSON

JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language, Standard ECMA-262 3rd Edition - December 1999. JSON is a text format that is completely language independent but uses conventions that are familiar to programmers of the C-family of languages, including C, C++, C#, Java, JavaScript, Perl, Python, and many others. These properties make JSON an ideal data-interchange language.

Many JSON formatters/parser for a wide list of languages can be found at www.json.org

2. JSON Protocol

This section describes the JSON format of data sent to remote server by WRTU.

Push Data Protocol includes 6 objects which can be presented in JSON data:

- Device Information
- Tag Information
- Modbus Tag Information
- Tag Data
- Alarm Data
- Event Data
- Datasnapshot

Each object will be described below.

Per each Push Data session WRTU system will send:

- One Device Information object
- List of Tag Information objects (one per each configured tag)
- List of Tag Data objects (one per each saved data record)
- List of Alarm Data objects (one per each saved data record)
- List of Event Data objects (one per each saved data record)
- Datasnapshots (if presented at moment of data push)

Also the all data will be included in **data** JSON object.
The sample JSON code of top level object is:

{ “data” : { *<other objects>* } }

2.1 Device Information Object

This object describes main device configuration values. It helps to identify device.
The object structure is following:

```
"DeviceConfig":
{
        "Serial"                    : string,
        "Name"                      : string,
        "Login"                     : string,
        "Password"                  : string,
        "RtuNumber"                 : number,
        "LoggerState"               : string,
        "PushFrequency"             : number,
        "Time"                      : string,
        "CGTime"                    : string,
        "ModemModel"                : string,
        "ModemRSSI"                 : number,
        "ModemSimStatus"            : string,
        "ModemRegStatus"            : string,
        "LteDiversityAntennaStatus"       : number,
        "GpsAntennaStatus"          : string,
        "FirmwareVersion"           : string,
        "HardwareModel"             : string,
        "IMEI"                      : string,
        "ICCID"                     : string,
        GpsInfo"            :
        {
                "Latitude"          : number,
                "Longitude"         : number,
                "Speed"             : number,
                "Heading"           : string
        }
}
```

Serial
Unique device serial number (read from hardware)

Name
WRTU device name

Login
Login entered on Data Pushing configuration section.
For BiPOM server it must be login for BiPOM Web Portal.
Other services can use this to do data source authorization.

Password
Password entered on Data Pushing configuration section.
For BiPOM server it must be password for BiPOM Web Portal.
Other services can use this to do data source authorization.

RtuNumber
WRTU device RTU number

LoggerState
WRTU system logger state.
Possible values: ***Started*** or ***Stopped***
Started – system collects data
Stopped – system do not collects data
Error – system cannot read logger state

Time
Current WRTU time set on RTC
The string format is ISO8601 (en.wikipedia.org/wiki/ISO_8601)
The example: 2014-07-08T12:00:00Z
Also possible value
Error – system cannot read RTC time

PushFrequency
The Push Frequency configured in device in minutes

CGTime
Time set on CloudGate modem. This field will have **null** value in case of 3G modem setup.
In case of CloudGate package this field will be set to time of CloudGate OS in ISO8601 format.

ModemModel
String which describes type of modem connected to WRTU device.

FirmwareVersion
String with firmware version.

HardwareModel
String which describes device model.

GpsInfo
GPS information from device

Latitude
GPS latitude coordinates as decimal degrees.

Longitude
GPS longitude coordinates as decimal degrees.

Speed
GPS speed over ground. Units is **knots**

Heading
GPS heading. Can be following string constants:
NE – North - East
NW – North – West
SE – South – East
SW – South – West

ModemRSSI
Modem's RSSI in dBm

ModemSimStatus
SIM Status/ Can be one of following text values:
Unknown – Status is unknown at the moment
SIM not inserted – SIM was not inserted
Ready – SIM inserted and ready to work
SIM PIN – SIM required PIN code to be unlocked
SIM PUK – SIM required PUN code to be unlocked
SIM failure – SIM card failed
Locked – SIM card is locked by provider
Not supported – Modem cannot obtain SIM status

ModemRegStatus
Modem's Registration status. Can be one of following text values:
Not registered – modem didn't registered on cell network
Registered – modem is registered on cell network
Searching ... – modem is searching network
Denied – registration denied
Unknown – modem cannot obtain current status
Roaming – modem registered in roaming network

LteDiversityAntennaStatus
Cloudgate based system reported its LTE antenna mode.
0 – LTE Diversity Antenna mode disabled
1 – LTE Diversity Antenna mode enabled

GpsAntennaStatus
Cloudgate based system reported its GPS antenna mode.
0 – GPS Antenna mode disabled
1 – GPS Antenna mode enabled

IMEI
IMEI number of modem

ICCID
ICCID number of SIM card

2.2 Tag Information Object

This object describes single tag configuration values. It helps to identify tag.
The object structure is following:

```
{
        "Id"              : number,
        "Name"            : string,
        "Type"            : string,
        "Units1"          : string,
        "Units2"          : string,
        "LogPeriod"       : number,
        "IsVMapEnabled": boolean,
        "IsBMapEnabled": boolean,
        "Address"         : number,
        "VirtualAddress"  : number,
        "ModbusInfo"      : object or null
        "ValueTextMapItems"      : object or null
        "BitMapItems"     : object or null
}
```

Id
Unique identifier of tag.

Name
Name of tag.

Type
Type of tag. Possible values:

DI	- digital input
DI OPTO-9	- digital input from OPTO 9 board (available in special OPTO version of hardware/software)
DI OPTO-8-DC	- digital input from OPTO 8 board
DO	- digital output
AI	- analog input
HR	- holding register
FC	- frequency counter on digital input
VRMS	- voltage RMS on analog input
MB	- Modbus Slave Device
DAQ2543	- DAQ2543 analog input
PC	- pulse counter on digital input
DS	- Datasnapshot tag

Units1 and **Units2**
Configured units text. For DI and DO tags Units1 represented value for OPEN state. Units2 represented state for CLOSED state. For other tag's types Units1 contains units text (like mV, V, mA, uA, Hz, etc)
Note, these fields can be empty if user do not provide any units for the tag value.

LogPeriod
Period in seconds for logging tag's data to persistent storage (SD card or DATAFLASH)

Address
Address of device's Modbus Register from what tag read value.
If **Type** is **MB** then this field set to **null**.

Address
Virtual Modbus address (started from 46000) which can be used to read calculated tag value as FLOAT.

ModbusInfo
Modbus Information Object if **Type** set to **MB**.
Otherwise set to **null**.

IsVMapEnabled
It can be true or false. If tag has configured Value Text Map Items then it will be true. Otherwise it is false.
If it is true then **ValueTextMapItems** array not null and contains some items.

IsBMapEnabled
It can be true or false. If tag has configured Bit Map Items then it will be true. Otherwise it is false.
If it is true then **BitMapItems** array not null and contains some items.

ValueTextMapItems
If tag has Values Map item then they provided here as array of pairs Value and Text
If tag does not have the tag's value mapping feature then this field will have zero array elements.

BitMapItems
If tag has Bit Map item then they provided here as array of objects with fields Position, Value0 and Value1
If tag does not have the tag's value mapping feature then this field will have zero array elements.

```
{
        "Position"          : number,
        "Value0"            : string,
        "Value1"            : string
}
```

Position
Bit position from 0 to 15

Value0
Text which assigned to bit value 0

Value1
Text which assigned to bit value 1

2.3 Modbus Tag Information Object

This object describes Modbus Slave Device register for tag which **Type** is set to **MB**.
The object structure is following:

```
"ModbusInfo":
{
        "RtuNumber"         : number,
        "Type"              : string,
        "ValueType"         : string,
        "ValueByteOrder"    : string,
        "Address"           : number
}
```

RtuNumber
RTU Number of Modbus Slave Device connected to RS485 port of WRTU device

Address
Modbus Register address on Modbus Slave Device

Type
Type of Modbus register

DI	- digital input
DO	- digital output
AI	- analog input
HR	- holding register

ValueType
Type of Modbus register value

INT	- 16 bit signed integer
UINT	- 16 bit unsigned integer
LONG	- 32 bit signed integer
ULONG	- 32 bit unsigned integer
FLOAT	- 32 bit float

ValueByteOrder
Byte order in raw Modbus register value

NS	- no swap, use bytes in its original order
BWS	- byte and word swap
BS	- byte swap
WS	- word swap

This option describes how bytes in raw value was proceed to get Calculated value.

2.4 Tag's Value Map Object

This object describes mapping between tag's value and text representation.
The object structure is following:

```
"ValueTextMapItems": [
        {
                "Value"         : number,
                "Text"          : string
        },
        {
                "Value"         : number,
                "Text"          : string
        },
        …
]
```

Value
Tag value

Text
Text associated with this value

2.5 Tag Data Object

This object describes Tag Data record.
The object structure is the following:

```
{
        "Id"                : number,
        "TagId"             : number,
        "Time"              : string,
        "RawValue"          : number,
        "RawValue2"         : number,
        "ConvertedValue"    : number
}
```

Id
Unique identifier of record.

TagId
Unique identifier of tag which generated this record.

Time
WRTU time when this record was logged
The string format is ISO8601 (en.wikipedia.org/wiki/ISO_8601)
The example: 2014-07-08T12:00:00Z

RawValue
Raw value read from the internal Modbus Register. Obsolete.

RawValue2
Raw value read from the internal Modbus Register. Always presented as unsigned integer 32 bit value.

ConvertedValue
Converted value which was calculated using Calculations rules or Virtual Map configured for tag.

2.6 Alarm Data Object

This object describes Alarm Data record.
The object structure is the following:

```
{
        "Id"                : number,
        "TagId"             : number,
        "Time"              : string,
        "Type"              : string,
        "RawValue"          : number,
        "ConvertedValue"    : number
}
```

Id
Unique identifier of record.

TagId
Unique identifier of tag which generated this record.

Time
WRTU time when this record was logged
The string format is ISO8601 (en.wikipedia.org/wiki/ISO_8601)
The example: 2014-07-08T12:00:00Z

Type
Alarm type. Possible values:

Low
LowLow
Normal
High
HighHigh
ValueChanged
ExactValue

RawValue
Raw value read from the internal Modbus Register

ConvertedValue
Converted value which was calculated using Calculations rules.

2.7 Event Data Object

This object describes Event Data record.
The object structure is the following:

```
{
        "Id"                    : number,
        "Time"                  : string,
        "Type"                  : string,
        "EventId"               : number,
        "ErrorCode"             : number
}
```

Id
Unique identifier of record.

Time
WRTU time when this record was logged
The string format is ISO8601 (en.wikipedia.org/wiki/ISO_8601)
The example: 2014-07-08T12:00:00Z

Type
Event type. Possible values:
Error
Warning
Information

EventId
Unique identifier of the event.
The list of events identifiers and their meaning listed in Appendix A.

ErrorCode
Error code related to the event of type **Error**.
The list of events identifiers and their meaning listed in Appendix B.

2.8 Datasnapshot Object

This object describes Datasnapshot record which presents data series like array of values.
The object structure is the following:

"Datasnapshots": [<datasnapshot items>]

Every datasnapshot Item has structure:

```
{
        "TagId": number,
        "Timestamp": string,
        "Name": string,
        "XUnits": string,
        "YUnits": string,
        "XData": [<array of float values>],
        "YData": [<array of float values>]
}
```

TagId
Unique identifier of DS Tag.

Timestamp
String with timestamp when datasnapshot was recorded in format: DD/MM/YYYY HH:MM:SS

Name
Name of datasnapshot

XUnits
Units of values on X axis (usually time units like ms, sec, etc

YUnits
Units of values on Y axis (usually unit sof measured signal like g, ips, V, mA, etc)

XData
Array of values for X axis (timestamps for example)

YData
Array of values for Y axis (measured signal values)

2.9 Examples

The device does not have tags and has not collected any data yet.


```
{ “data” :
        {
                “DeviceConfig”:
                {
                        “Serial”                : “1234-5678-9012-3456”,
                        “Name”                  : “WRTU”,
                        “Login”                 : “admin”,
                        “Password”              : “demopwd”,
                        “RtuNumber”             : 1,
                        “PushFrequency”         : 10,
                        “LoggerState”           : “Started”,
                        “Time”                  : “2014-07-29T12:00:00Z”,
                        “ModemModel”            : “CG”,
                        “ModemRSSI”             : 21,
                        “ModemSimStatus”        : “Ready”,
                        “ModemRegStatus”        : “Searching …”,
                        “LteDiversityAntennaStatus”     : 0,
                        “GpsAntennaStatus”      : 1,
                        “FirmwareVersion”       : “1.01”,
                        “HardwareModel”         : “nanoWiPOM”,
                        “IMEI”                  : “AA-BBBBBB-CCCCCC-D”,
                        “ICCID”                 : “891004234814455936”,
                        “GpsInfo”               :
        {
                                “Latitude”      : 30.7233095,
                                “Longitude”     : 46.482526,
                                “Speed”         : 1.1234,
                                “Heading”       : “NE”
                        }
                }
        }
}
```

The device has tags but has not collected any data yet.


```
{ “data” :
        {
                “DeviceConfig”:
                {
                        “Serial”                : “1234-5678-9012-3456”,
                        “Name”                  : “WRTU”,
                        “Login”                 : “admin”,
                        “Password”              : “demopwd”,
                        “RtuNumber”             : 1,
                        “PushFrequency”         : 10,
                        “LoggerState”           : “Started”,
                        “Time”                  : “2014-07-29T12:00:00Z”,
                        “ModemModel”            : “CG”,
                        “ModemRSSI”             : 21,
                        “ModemSimStatus”        : “Ready”,
                        “ModemRegStatus”        : “Searching …”,
                        “LteDiversityAntennaStatus”     : 0,
                        “GpsAntennaStatus”      : 1,
                        “FirmwareVersion”       : “1.01”,
                        “HardwareModel”:        “nanoWiPOM”,
                        “IMEI”                  : “AA-BBBBBB-CCCCCC-D”,
                        “ICCID”                 : “8910042348144559 36”,
                        “GpsInfo”               :
                        {
                                “Latitude”      : 30.7233095,
                                “Longitude”     : 46.482526,
                                “Speed”         : 1.1234,
                                “Heading”       : “NE”
                        }
                },
                “TagInfoList”:
                [
                        {
                                “Id”            : 1,
                                “Name”          : “Tag 1”,
                                “Type”          : “DI”,
                                “Address”       : 10001,
                                “VirtualAddress” : 46000,
                                “Units1”        : “STATE1”,
                                “Units2”        : “STATE2”,
                                “ModbusInfo”    : null,
                                “IsVMapEnabled”: false,
                                “IsBMapEnabled”: false,
                                “ValueTextMapItems”     : null
                                “BitMapItems”   : null
                        },

                        {
                                “Id”            : 2,
                                “Name”          : “Tag 2”,
```

```
                                    “Type”              : “MB”,
                                    “Address”           : null,

                                    “ModbusInfo”     :
                                    {
                                            “ValueType”: “UINT”,
                                            “ValueByteOrder”: “NS”,
                                            “Type”: “HR”,
                                            “RtuNumber”: 2,
                                            “Address”: 40001
                                    },
                                    “IsVMapEnabled”: true,
                                    “IsBMapEnabled”: true,
                                     “ValueTextMapItems”      :
                                    {
                                            {Value:1,Text:“One”},
                                            {Value:2,Text:“Two”},
                                            {Value:3,Text:“Three”}
                                    },
                                    “BitMapItems”     :
                                    {
                                            {Position:0, Value0:“Bad” , Value1:“Good”},
                                            {Position:1, Value0:“Fail” , Value1:“Success”},
                                            {Position:2, Value0:“Active” , Value1:“Inactive”},
                                    }

                            }
                    ]
            }
}
```

The device has tags and has collected some data.


```
{ “data” :
        {
                “DeviceConfig”:
                {
                        “Serial”                : “1234-5678-9012-3456”,
                        “Name”                  : “WRTU”,
                        “Login”                 : “admin”,
                        “Password”              : “demopwd”,
                        “RtuNumber”             : 1,
                        “PushFrequency”         : 10,
                        “LoggerState”           : “Started”,
                        “Time”                  : “2014-07-29T12:00:00Z”,
                        “ModemModel”            : “CG”,
                        “ModemRSSI”             : 21,
                        “ModemSimStatus”        : “Ready”,
                        “ModemRegStatus”        : “Searching …”,
                        “LteDiversityAntennaStatus”     : 0,
                        “GpsAntennaStatus”      : 1,
                        “FirmwareVersion”       : “1.01”,
                        “HardwareModel”:        “nanoWiPOM”,
                        “IMEI”                  : “AA-BBBBBB-CCCCCC-D”,
                        “ICCID”                 : “891004234814455936”,
                        “GpsInfo”               :
                        {
                                “Latitude”      : 30.7233095,
                                “Longitude”     : 46.482526,
                                “Speed”         : 1.1234,
                                “Heading”       : “NE”
                        }
                },
                “TagInfoList”: [
                        {
                                “Id”            : 1,
                                “Name”          : “Tag 1”,
                                “Type”          : “DI”,
                                “Address”       : 10001,
                                “VirtualAddress” : 46000,
                                “Units1”        : “STATE1”,
                                “Units2”        : “STATE2”,
                                “ModbusInfo”    : null,
                                “IsVMapEnabled”: false,
                                “IsBMapEnabled”: false,
                                 “ValueTextMapItems”    : null,
                                “BitMapItems”   : null
                        },
                        {
                                “Id”            : 2,
                                “Name”          : “Tag 2”,
                                “Type”          : “MB”,
                                “Address”       : null,
```

```
                    "VirtualAddress"  : 46002,
                    "Units1"          : "mV",
                    "Units2"          : "",
                    "ModbusInfo"      : {
                            "Type": "HR",
                            "ValueType": "UINT",
                            "ValueByteOrder": "NS",
                            "RtuNumber": 2,
                            "Address": 40001
                    },
                    "IsVMapEnabled": true,
                    "IsBMapEnabled": true,
                     "ValueTextMapItems"      : {
                            {Value:1,Text:"One"},
                            {Value:2,Text:"Two"},
                            {Value:3,Text:"Three"}
                    },
                    "BitMapItems"     : {
                            {Position:0, Value0:"Bad" , Value1:"Good"},
                            {Position:1, Value0:"Fail" , Value1:"Success"},
                            {Position:2, Value0:"Active" , Value1:"Inactive"},
                    }
            }
        ],
        "TagDataList": [
            {
                    "Id"                    : 1,
                    "TagId"                 : 1,
                    "Time"                  : "2014-07-29T12:00:00Z",
                    "RawValue"              : 0,
                    "RawValue2"             : 0,
                    "ConvertedValue"        : 0
             },
             {
                    "Id"                    : 2,
                    "TagId"                 : 1,
                    "Time"                  : "2014-07-29T12:00:00Z",
                    "RawValue"              : 1,
                    "RawValue2"             : 1,
                    "ConvertedValue"        : 1
             },
             {
                    "Id"                    : 3,
                    "TagId"                 : 2,
                    "Time"                  : "2014-07-29T12:00:00Z",
                    "RawValue"              : 10,
                    "RawValue2"             : 10,
                    "ConvertedValue"        : 10
            }
        ]
    }
}
```

The device has tags and collected some data. Also included Alarms and Events.


```
{ “data” :
        {
                “DeviceConfig”:
                {
                        “Serial”                : “1234-5678-9012-3456”,
                        “Name”                  : “WRTU”,
                        “Login”                 : “admin”,
                        “Password”              : “demopwd”,
                        “RtuNumber”             : 1,
                        “PushFrequency”         : 10,
                        “LoggerState”           : “Started”,
                        “Time”                  : “2014-07-29T12:00:00Z”,
                        “ModemModel”            : “CG”,
                        “ModemRSSI”             : 21,
                        “ModemSimStatus”        : “Ready”,
                        “ModemRegStatus”        : “Searching …”,
                        “LteDiversityAntennaStatus”     : 0,
                        “GpsAntennaStatus”      : 1,
                        “FirmwareVersion”       : “1.01”,
                        “HardwareModel”:        “nanoWiPOM”,
                        “IMEI”                  : “AA-BBBBBB-CCCCCC-D”,
                        “ICCID”                 : “891004234814455936”,
                        “GpsInfo”               :
                        {
                                “Latitude”      : 30.7233095,
                                “Longitude”     : 46.482526,
                                “Speed”         : 1.1234,
                                “Heading”       : “NE”
                        }
                },
                “TagInfoList”:
                [
                        {
                                “Id”            : 1,
                                “Name”          : “Tag 1”,
                                “Type”          : “DI”,
                                “Address”       : 10001,
                                “VirtualAddress”  : 46000,
                                “Units1”        : “STATE1”,
                                “Units2”        : “STATE2”,
                                “ModbusInfo”    : null,
                                “IsVMapEnabled”: false,
                                “IsBMapEnabled”: false,
                                “BitMapItems”   : null,
                                “ValueTextMapItems”     : null

                        },
                        {
                                “Id”            : 2,
                                “Name”          : “Tag 2”,
```

```
                    “Type”              : “MB”,
                    “Address”           : null,
                    “VirtualAddress”    : 46002,
                    “Units1”            : “mV”,
                    “Units2”            : “”,
                    “ModbusInfo”        :
                    {
                            “Type”: “HR”,
                            “ValueType”: “UINT”,
                            “ValueByteOrder”: “NS”,
                            “RtuNumber”: 2,
                            “Address”: 40001
                    },
                    “IsVMapEnabled”: true,
                    “IsBMapEnabled”: false,
                    “BitMapItems”       : null,
                    “ValueTextMapItems”         :
                    {
                            {Value:1,Text:“One”},
                            {Value:2,Text:“Two”},
                            {Value:3,Text:“Three”}
                    }

            }
    ],
    “TagDataList”:
    [
            {
                    “Id”                        : 1,
                    “TagId”                     : 1,
                    “Time”                      : “2014-07-29T12:00:00Z”,
                    “RawValue”                  : 0,
                    “RawValue2”                 : 0,
                    “ConvertedValue”            : 0
             },
             {
                    “Id”                        : 2,
                    “TagId”                     : 1,
                    “Time”                      : “2014-07-29T12:00:00Z”,
                    “RawValue”                  : 1,
                    “RawValue2”                 : 1,
                    “ConvertedValue”            : 1
             },
             {
                    “Id”                        : 3,
                    “TagId”                     : 2,
                    “Time”                      : “2014-07-29T12:00:00Z”,
                    “RawValue”                  : 10,
                    “RawValue2”                 : 10,
                    “ConvertedValue”            : 10
            }
    ],
```

```
                "AlarmDataList":
                [
                        {
                                "Id"                    : 3,
                                "TagId"                 : 2,
                                "Time"                  : "2014-07-29T12:00:00Z",
                                "Type"                  : "HighHigh",
                                "RawValue"              : 10,
                                "ConvertedValue"        : 10
                        }
                ],



                 "EventDataList":
                 [
                        {
                                "Id"            : 3,
                                "Time"          : "2014-07-29T12:00:00Z",
                                "Type"          : "Information",
                                "EventId"       : 43,
                                "ErrorCode"     : 9
                        }
                ]
        }
}
```

JSON file with collected Datasnapshots


```
{
   "data": {
      "DeviceConfig": {
         "Serial": "KM4AKB5015",
         "Name": "WiPOM",
         "Login": "test",
         "Password": "test",
         "RtuNumber": "31",
         "PushFrequency": "300",
         "Time": "2023-08-04T11:48:44Z",
         "LoggerState": "Started",
         "ModemModel": "CloudGate Mini",
         "ModemRSSI": "-125",
         "ModemSimStatus": "SIM not inserted",
         "ModemRegStatus": "Not registered.",
         "LteDiversityAntennaStatus": "0",
         "GpsAntennaStatus": "0",
         "IMEI": "867698040640578",
         "ICCID": "",
         "FirmwareVersion": "2.02",
         "HardwareModel": "WiPOM Cloudgate",
         "NetworkAddressList": [],
         "GpsInfo": {
            "Latitude": 0.000000,
            "Longitude": 0.000000,
            "Speed": 0.000000,
            "Satellite": 0,
            "Heading": "NE"
         }
      },
      "TagInfoList": [{
            "Id": 1,
            "Name": "8C1F64211101FD5C - Acceleration",
            "Units1": "g",
            "Units2": "",
            "LogPeriod": 0,
            "IsVMapEnabled": false,
            "IsBMapEnabled": false,
            "Type": "DS",
            "Address": null,
            "VirtualAddress": 0,
            "BitMapItems": [],
            "ValueTextMapItems": [],
            "ModbusInfo": {
               "RtuNumber": 0,
               "Type": "DO",
               "ValueType": "INT",
               "ValueByteOrder": "NS",
               "Address": 0
            }
```

```
        }, {
          "Id": 2,
          "Name": "8C1F64211101FD5C - Loadcell",
          "Units1": "pounds",
          "Units2": "",
          "LogPeriod": 0,
          "IsVMapEnabled": false,
          "IsBMapEnabled": false,
          "Type": "DS",
          "Address": null,
          "VirtualAddress": 0,
          "BitMapItems": [],
          "ValueTextMapItems": [],
          "ModbusInfo": {
            "RtuNumber": 0,
            "Type": "DO",
            "ValueType": "INT",
            "ValueByteOrder": "NS",
            "Address": 0
          }
        }
      ],
      "EventDataList": [],
      "AlarmDataList": [],
      "TagDataList": [],
      "Datasnapshots": [{
          "TagId": "1",
          "Timestamp": "27/10/2012 17:17:21",
          "Name": "Acceleration",
          "XUnits": "ms",
          "YUnits": "g",
          "XData": [0, 100, 200, 300, 400, 500],
          "YData": [0.00, 0.00, 0.00, 0.00, 0.00, 0.00]
        }, {
          "TagId": "2",
          "Timestamp": "27/10/2012 17:17:21",
          "Name": "Loadcell",
          "XUnits": "ms",
          "YUnits": "pounds",
          "XData": [0, 100, 200, 300, 400, 500],
          "YData": [0.00, 0.00, 0.00, 0.00, 0.00, 0.00]
        }
      ]
    }
}
```

2.10 Server Response

For every request the server sends a response with JSON object.

```
{
        "Status"        : boolean,
        "Message"       : string,
        "ErrorCode"     : number
}
```

Status
Boolean value which indicates if data was processed by server successfully or not.
Possible values:
true : data processed successfully
false : data was not processed because of error. Error message should be put to Message field.

ErrorCode
The number which defined error code returned by server script

1001 – User not valid. That means that Login/Password doesn't match any registered account on web portal.

1002 – Device not found. That means that Serial number of device was not found in database. SO device is not registered on web portal.

1003 – Device permissions denied. That means that Serial number of device was found in database but this device doesn't belong to account specified with Login/Password fields. So device belong to another account.

1004 – General Failure. This error returned if server encountered some error (not related to pushed device info). In general this means some issue on server side.

Message
Text description of error if **Status** set to false. It should be empty string like a **""** if no error and **Status** set to **true.**

For every error code server return predefined text message.

1001 - "User is not valid."
1002 - "Device with Serial [serial number] is missing in database."
1003 - "Device with Serial [serial number] is not under your control."
1004 - "Error occurred and information about error sent to tech support."

NOTE: It was designed for old versions. Now it presents in protocol just for backward compatibility.

Appendix A: Event Identifiers

Code	Description
0	None event
1	System started
2	Storage devices initialization failed
3	Cell driver initialization
4	RS485 driver initialization
5	UART0 driver initialization
6	DIO subsystem initialization
7	ADC initialization
8	Display initialization
9	Initializing GPRS layer on cell modem
10	Closing GPRS layer on cell modem
12	GPRS TCP server starting
13	GPRS TCP server stopping
14	GPRS modem hardware reset
15	Save device configuration to disk failed (inside protocol command)
16	USB driver initialization
17	Add tag
18	Update tag
19	Load tag
20	UART2 initialization
21	UART3 initialization
22	TLC2543 initialization
23	Add contact
24	Load contacts failed
25	Load device configuration failed
26	Load tags failed
27	Save tags failed
28	Add Alarm Message Record
29	Load Alarm Message Record failed
30	Save Alarm Message Record failed
31	Load tag failed
32	Cell Communication was enabled
33	Cell Communication was disabled
34	Configuration Storage Device Id (Id of device where stored configuration)
35	Log Data Storage Device Id (Id of device where stored log records)
36	Alarm SMS sending failed (after 5 attempts)
37	Alarm SMS sent successfully
38	Initialize DI in COUNTER mode failed
39	Start DI COUNTER failed
40	Stop DI COUNTER failed
41	Detecting cell modem

Code	Description
42	Alarm email sending failed
43	Alarm email sent successfully
44	Load device configuration failed
45	Load APN configuration failed
46	Load peripheral devices configuration failed
47	Load pushing data configuration failed
48	Load SMTP configuration failed
49	Load internal counters failed
50	Cell modem re-initialized
51	Modem model
52	Modem read data timed out
53	TCP client stopped on cell modem
54	TCP client started on cell modem
55	TCP connection closed by peer
56	Test incoming TCP connection failed
57	TCP server closed
58	TCP server opened
59	Cell network status
60	Cell network status read
61	Cell network registration state
62	Cell network registration state read
63	SIM card error
64	SIM card status code
65	SIM card status read
66	CSQ level in dBm
67	CSQ status as raw value from modem
68	CSQ level read
69	GPRS layer closed
70	GPRS layer opened
71	GPRS configured
72	Modem status updated
73	Error code of last AT modem command
74	Software reset of cell modem
75	Hardware reset of cell modem
76	Cell modem write data timed out
77	SMTP error code
78	Software restarted by user request
79	Firmware revision
80	Data Push Completed Successfully
81	Data Push Failed. Data field contains error code.
82	Data Push HTTP response status code
83	Modem was restored form binary mode

Code	Description
84	Read Response from remote server failed
85	Error code returned by remote server as result of Data Push
86	Delete Tag Failed

Appendix B: Error Codes

General

Internal errors (not shown on LCD).

Code	Description
1	Invalid Argument. Some function received wrong input data.
2	Queue is empty when trying to read next alarm/event from queue
3	Alarm/event queue is locked
4	Timeout on wait operation

Application Subsystem

Code	Description
101	Starting main task failed
102	Starting cell modem task failed
103	Starting RS485 server task failed
104	Starting USB server task failed
105	Starting UART0 server task failed
106	Starting data logger task failed

Configuration Subsystem

Code	Description
201	No space for new tags
202	Load device configuration failed
203	Load tag's configuration failed
204	No space for new contact record
205	Invalid contact record ID
206	Invalid contact record index
207	Unsupported version of contact record
208	Load contact records failed
209	Load message records failed
210	No space for new message record
211	Invalid message record ID
212	Invalid message record index
213	Unsupported version of message record
214	Unsupported version of tag configuration

Core Modbus Subsystem

Code	Description
401	Unsupported register address
402	Unknown function ID
403	RTU is incorrect in reply
404	Function ID is incorrect in reply
405	CRC16 is incorrect in reply

Modbus RTU Subsystem

Code	Description
501	Request data is not complete (broken)
502	Too big request data (no space in internal buffer)
503	Unknown function ID
504	Bad CRC16 of MODBUS request/reply
505	Processing MODBUS request failed

Modbus TCP Subsystem

Code	Description
601	Request data is not complete (broken)
602	Too big request data (no space in internal buffer)
603	Unknown function ID
604	Processing MODBUS request failed
605	Unknown Protocol ID
606	Length in Modbus TCP header is incorrect

RS485 Driver

Code	Description
701	RS485 driver is not initialized
702	Failed to clear RX buffer
703	Failed to clear TX buffer
704	Read Timeout
705	Write Timeout
706	No data to read
707	Echo not received

Cell Modem Driver

Code	Description
801	Cell Modem Driver is not initialized
802	Failed to clear RX buffer
803	Failed to clear TX buffer
804	Read Timeout
805	Write Timeout
806	Read operation didn't return any data
807	No incoming TCP connection
808	No reply for AT command
809	Unknown reply for AT command
810	Data to read is available

Hardware Subsystem

Code	Description
901	Hardware subsystem not initialized
902	DAQ2543 / ADC self-test failed
903	DAQ2543 / ADC not initialized
904	Incorrect ADC channel number
905	Incorrect DI pin number
906	Incorrect DO pin number
907	Write DO failed
908	Read DI failed
909	LCD Contrast adjustment failed
910	LCD Backlight adjustment failed
911	LCD initialization failed
912	Incorrect LCD line number
913	Configure Cell Modem input port failed
914	DATAFLASH initialization failed
915	SD card initialization failed
916	No storage device detected (no SD card and no DATAFLASH)
917	Incorrect frequency channel number
918	Incorrect DAQ2543 channel number

Data Storage Subsystem

Code	Description
1001	Unknown storage device ID
1002	Storage device not initialized
1003	Version structure has incorrect signature byte
1004	Version structure has incorrect version byte
1005	Version structure has incorrect LRC byte
1006	Data block has incorrect CRC16
1007	No data available to read
1008	Deep data check failed (read data is different from wrote data)
1009	Read operation failed
1010	Write operation failed
1011	Find structure not initialized
1012	Search action already started
1013	Find end of log records
1014	Sector number is incorrect

UART1 Driver

Code	Description
1101	UART1 driver is not initialized
1102	Failed to clear RX buffer
1103	Failed to clear TX buffer
1104	Read Timeout
1105	Write Timeout
1106	No data to read

USB Driver

Code	Description
1201	UART1 driver is not initialized
1202	Failed to clear RX buffer
1203	Failed to clear TX buffer
1204	Read Timeout
1205	Write Timeout
1206	No data to read

Communication Protocol

Code	Description
1301	Unknown command received

Appendix C: Modem Subsystem Error Codes

In case of following Events Data field contains special Modem Subsystem error codes. These codes came from modem library so it is not part of software error codes range.

Events which has Modem Subsystem Error Code in data field:

Event Id	Description
9	Initializing GPRS layer on cell modem
10	Closing GPRS layer on cell modem
12	GPRS TCP server starting
13	GPRS TCP server stopping
41	Detecting cell modem
50	Cell modem re-initialized
51	Modem model
52	Modem read data timed out
53	TCP client stopped on cell modem
54	TCP client started on cell modem
55	TCP connection closed by peer
56	Test incoming TCP connection failed
57	TCP server closed
58	TCP server opened
59	Cell network status
60	Cell network status read
61	Cell network registration state
62	Cell network registration state read
63	SIM card error
64	SIM card status code
65	SIM card status read
66	CSQ level in dBm
67	CSQ status as raw value from modem
68	CSQ level read
69	GPRS layer closed
70	GPRS layer opened
71	GPRS configured
72	Modem status updated
73	Error code of last AT modem command
74	Software reset of cell modem
75	Hardware reset of cell modem
76	Cell modem write data timed out
77	SMTP error code
83	Modem was restored form binary mode

Error Code	Description
0	No error
1	Operation timed out
2	Operation Failed
3	Modem library is not initialized
4	Bad Reply from AT command
5	Bad Argument passed to Modem Library Function
6	Cannot clear RX buffer
7	Cannot clear TX buffer
8	Open GPRS Connection Failed
9	Close GPRS Connection Failed
10	Open TCP Server Failed
11	Close TCP Server Failed
12	Open TCP Client Failed
13	Close TCP Client Failed
14	No incoming connection detected
15	Incoming connection detected
16	Connection was dropped
17	No data detected
18	Not Supported
19	AT command failed (no response from modem)
20	AT command failed (returned unexpected reply)
21	AT+CGMM command failed (no response from modem)
22	AT+CMEE command failed (no response from modem)
23	AT+WIND command failed (no response from modem)
24	AT+WIND command failed (returned unexpected reply)
25	AT+CMGF command failed (no response from modem)
26	AT+CMGF command failed (returned unexpected reply)
29	AT+CSQ command failed (no response from modem)
30	AT+CSQ command failed (returned unexpected reply)
31	AT+CSQ command failed (didn't returned OK reply)
32	AT+CPIN command failed (no response from modem)
33	AT+CREG command failed (no response from modem)
34	AT+CREG command failed (returned unexpected reply)
35	AT+CREG command failed (didn't returned OK reply)
36	AT+RFSTS command failed (no response from modem)
37	AT+RFSTS command failed (returned unexpected reply)
38	AT+RFSTS command failed (didn't returned OK reply)
39	AT+RFSTS command failed (didn't returned command result)
40	AT+WSTR command failed (no response from modem)
41	AT+WSTR command failed (returned unexpected reply)
42	AT+WSTR command failed (didn't returned OK reply)
43	AT#GPRSMODE command failed (no response from modem)

44	AT#GPRSMODE command failed (returned unexpected reply)
45	AT#DLEMODE command failed (no response from modem)
46	AT#DLEMODE command failed (returned unexpected reply)
47	AT#APNSERV command failed (no response from modem)
48	AT#APNSERV command failed (returned unexpected reply)
49	AT#APNUN command failed (no response from modem)
50	AT#APNUN command failed (returned unexpected reply)
51	AT#APNPW command failed (no response from modem)
52	AT#APNPW command failed (returned unexpected reply)
53	AT#CGATT command failed (no response from modem)
54	AT#CGATT command failed (returned unexpected reply)
55	AT#CONNECTIONSTART command failed (no response from modem)
56	AT#CONNECTIONSTART command failed (returned unexpected reply)
57	AT#CONNECTIONSTART command failed (IP is not returned in reply)
58	AT#CONNECTIONSTART command failed (connection is not set)
59	AT#CONNECTIONSTOP command failed (no response from modem)
60	AT#CONNECTIONSTOP command failed (returned unexpected reply)
61	AT#TCPPORT command failed (no response from modem)
62	AT#TCPPORT command failed (returned unexpected reply)
63	AT#LTCPSTART command failed (no response from modem)
64	AT#LTCPSTART command failed (returned unexpected reply)
65	AT#LTCPSTOP command failed (no response from modem)
66	AT#LTCPSTOP command failed (returned unexpected reply)
67	AT# TCPSERV command failed (no response from modem)
68	AT#OTCP command failed (no response from modem)
69	AT#OTCP command failed (returned unexpected reply)
70	Sending ETX command failed (no response from modem)
78	Sending ETX command failed (no INFO response from modem)
79	Sending ETX command failed (no OK response from modem)
80	Sending ETX command failed (unexpected response from modem)
81	AT#CMGS command failed (no response from modem)
82	AT#CMGS command failed (sending SMS text failed)
83	AT#CMGS command failed (sending SUB symbol failed)
84	AT#CMGS command failed (read reply timed out)
85	AT#CMGS command failed (returned unexpected reply)
86	AT# CMEE command failed (returned error reply)
87	AT#CGMM command failed (returned error reply)
88	NO CARRIER reply received
89	NO ANSWER reply received
90	Empty reply from AT command received
91	AT+CPIN command failed (no response from modem)
92	AT#TCPSERV command failed (returned unexpected reply)
93	ATI command failed (no response from modem)

94	ATI command failed (returned unexpected reply)
95	ATDT command failed (no response from modem)
96	ATDT command failed (returned unexpected reply)
97	AT+SMSM2M command failed (no response from modem)
98	AT+NETSTATE command failed (no response from modem)

Appendix D: Modem Error Codes (AT command result)

If modem failed and any AT command returned unexpected or error response the system try to extract error code and log with event **#73 Error code of last AT modem command**.
So **Data** field for this event contains modem's error code returned by AT command.
It is internal modem errors and their list can be found in modem documentation files.

https://www.multitech.net/developer/wp-content/uploads/2010/10/S000463C.pdf
http://www.multitech.com/manuals/s000457I.pdf
http://www.multitech.com/manuals/s000574_1_0_2.pdf