

GW-ETH-02A

IQRF Ethernet Gateway

Firmware v2.73

User's Guide



Description

GW-ETH-02A is an IQRF gateway for connection between IQRF and Ethernet networks allowing remote monitoring, data collection and control of IQRF network.

Main components are: 32b microcontroller, Ethernet controller, EEPROM memory, serial Flash memory, SD memory card, IQRF transceiver module with antenna and RTCC.

The gateway can communicate outside the IQRF network via Ethernet. Configuration is possible via internal www server, IQRF IDE or SD card.

GW-ETH-02A allows communication with IQRF IDE to configure internal TR module and simply create IQRF networks. It is fully compatible with the DPA protocol. Non-DPA applications are supported as well.

GW-ETH-02A supports exchanging data with any cloud server designed according to IQRF Cloud server specification.



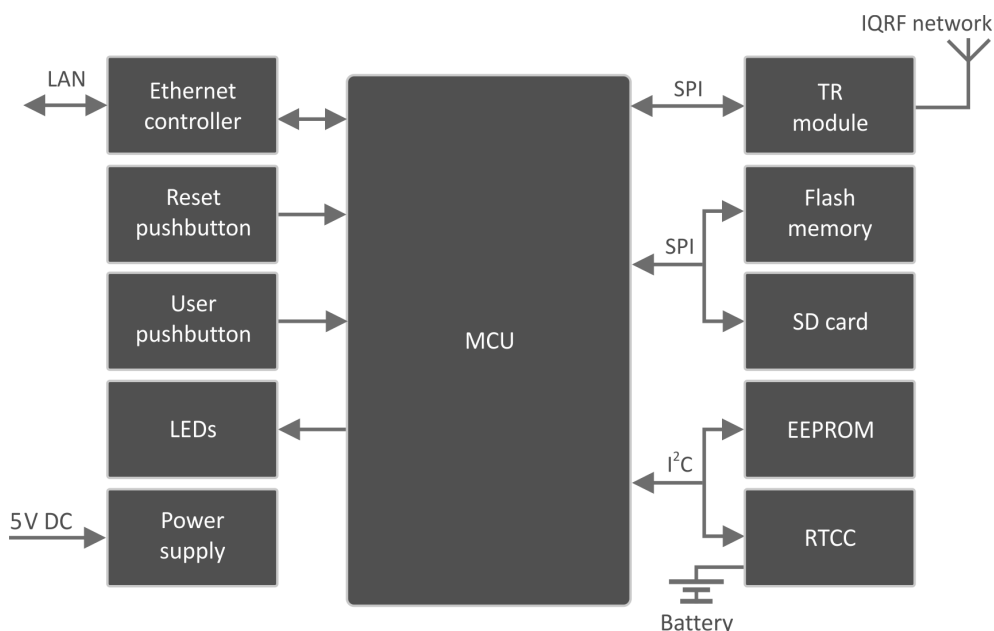
Applications

- Remote monitoring and control
- Data acquisition / collection
- Datalogger, IQRF Cloud supported
- Interface to building / home automation
- Connection of more IQRF networks to single PC
- DPA as well as non-DPA applications supported

Key features

- HTTP client for communication with IQRF Cloud server
- HTTP server for remote management
- UDP server/client for communication with IQRF network
- DDNS support
- SNTP client for getting date and time from Internet
- DHCP client for automated getting of IP address
- NBNS server for using names instead of IP addresses
- RTCC (real time clock/calendar)
- Firmware upgrade via web server / SD card
- Upgrade of application in internal TR module via web server / IQRF IDE / SD card
- DPA and IQRF IDE compatible

Block diagram



This gateway can be used either with TR as well as with DCTR transceivers. For simplicity, only TR is mainly used further on throughout this document.

Electrical specifications (Typical values unless otherwise stated)

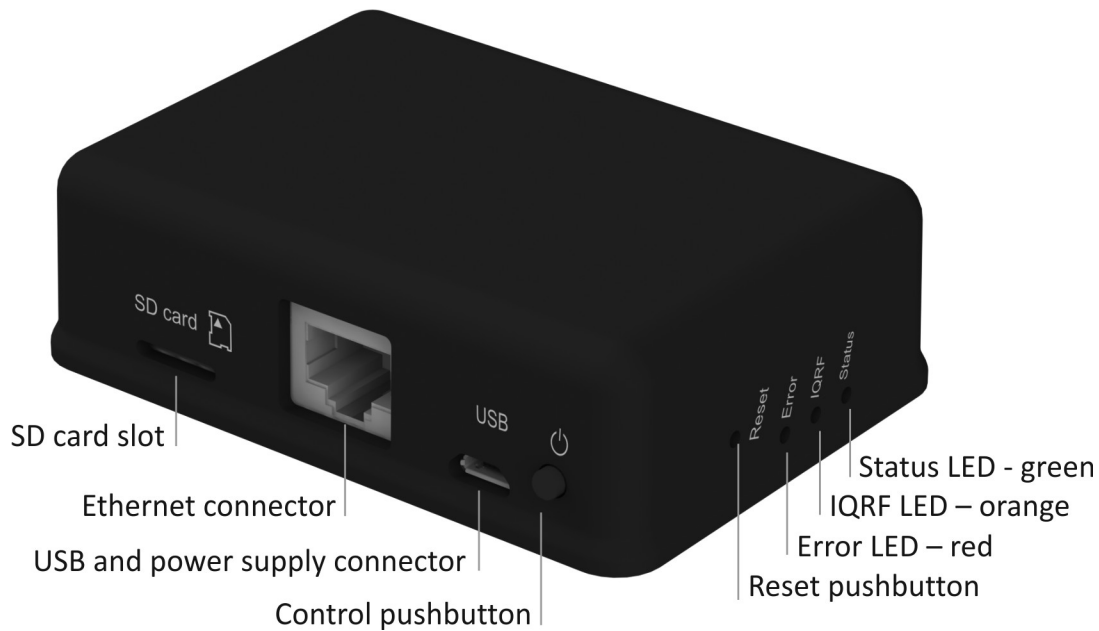
Power supply	5.0 ± 0.35 V DC
RTCC backup battery	CR2032 3 V, 215 mAh
Supply current	
Off	
USB cable disconnected	1 µA
USB cable connected	4 mA
Operating	
TR and Ethernet inactive	150 mA
Additional current	
TR active	See datasheet of TR module
Ethernet active	50 mA
Temperature range	
Operating	0 °C to +60 °C
Storage	10 °C to +20 °C (recommended)
IQRF	
Frequency bands	868 MHz or 916 MHz (SW selectable)
RF output power	According to TR module, programmable
TR module	DCTR-52DA
Antenna	PCB antenna built-in TR module
Flash memory	SST25VF080B, 8 Mb, 100 000 erase/write cycles typ.
SD card	Up to 2 GB
Ethernet	100BASE-TX
USB	Custom class
Dimensions	87 mm x 62 mm x 26 mm
Weight	70 g

Absolute maximum ratings

Stresses above those values may cause permanent damage to the device. Exposure to maximum rating conditions for extended periods may affect device reliability.

Supply voltage (VCC)	5.5 V
Storage temperature	-20 °C to +60 °C

Hardware

**Power supply**

GW-ETH-02A should be supplied via standard micro USB connector by external stabilized 5 V DC, e.g. from the power source delivered with the GW or from USB interface.

Ethernet

Ethernet/LAN line should be connected via standard 8-pin RJ-45 connector.

Pushbuttons

Both Reset and Control pushbutton functionality is fixed and can not be changed in application program.

Control

- Short press (< 1 s): no effect
- Long press (>1 s, < 10 s): GW off
- Long press (> 10 s): restore the factory settings of the gateway. (After 10 s all LEDs get off to indicate that the factory setting was restored.)

Reset

Reset button can be pressed by a pin through the hole in the case. It is intended to completely initialize the gateway.

LEDs

See Appendix 1 – LED indication.

IQRF

DCTR-52DA or DCTR-72DA wireless transceiver module is used for IQRF connectivity. Antenna is built in DCTR module.

Flash memory

Log data is stored in circular buffer in Flash memory. When it is full and a subsequent write is performed, then it starts overwriting the oldest data.

There is 252 KB dedicated to IQRF RX data and 128 KB for IQRF TX data and same size for System log.

The number of records of IQRF RX/TX data depends on the parameter `Packet size`, which define how many payload data bytes is dedicated for every data record. For default setting (`Packet size = 64 B`) there is 3308 positions for IQRF RX and 1680 positions for IQRF TX. For System log there is always 6553 positions in the buffer.

The actual size of the data log is the `Packet size + 14 B`, where the additional 14 bytes are used for saving date, time and index of the log. In this way the user can calculate actual number of positions in the buffer.

Data volumes and recording frequency must be taken in account with respect to the Flash memory endurance.

When the `Packet size` is changed in the GW settings, all logs are cleared.

Case

Caution: It is not allowed to open the GW case otherwise the device may be damaged.

Operation

Start up

GW-ETH-02A is turned on by USB power supply connecting.

Initialization

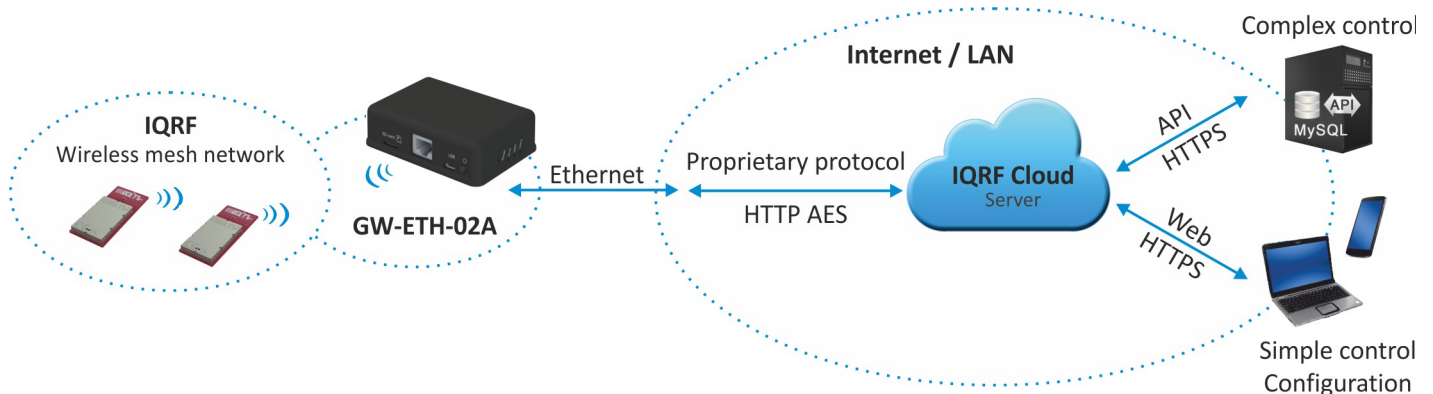
- After the start-up, the GW checks its own hardware first. If there is no critical error it starts to initialize Ethernet. When a critical error occurs, the execution does not continue and the error code is indicated by LEDs.

Communication

The size of payload IQRF data transmitted between the GW and the IQRF network is limited to 64 B in both directions.

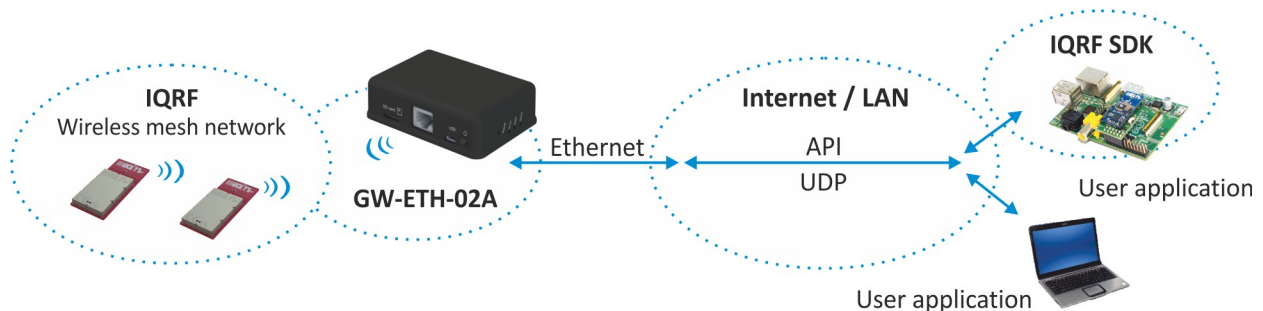
GW-ETH-02A can work in the following modes:

Datalogger mode



- All incoming IQRF data (IQRF RX) is stored and logged in internal Flash memory. When used with IQRF Cloud, the logged data is transmitted to the Cloud server always after the Cloud period elapsed. See chapters *IQRF IDE – GW Tool* and *Web server*.
- Data to be sent to IQRF (IQRF TX) is stored in internal Flash memory. When used with IQRF Cloud, the data is stored in the Cloud server first, transferred to the GW always after the Cloud period elapsed and then forwarded to IQRF network.
- If the communication between the GW and the Cloud server failed, the GW indicates an error.

Gateway mode



- Direct connection between IQRF networks and remote device via UDP channel is established.
- The communication uses a specific application protocol, see chapter *Application protocol for UDP channel*.
- Errors in communication between the GW and the remote device should be solved by the user application.

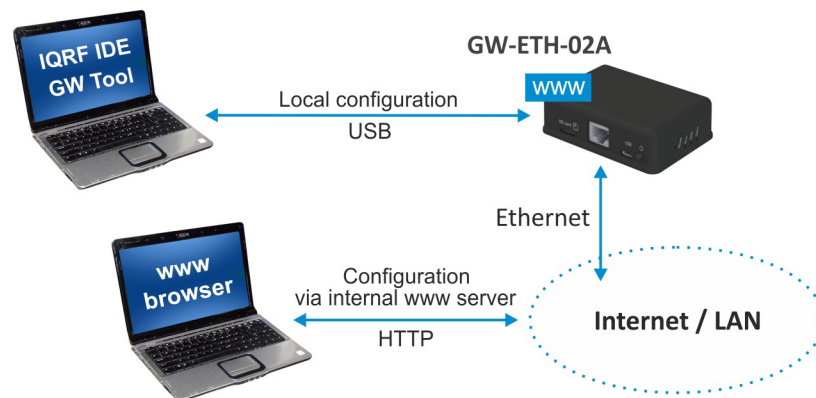
Using IQRF IDE

- The IQRF IDE **GW Tool** is intended for GW configuration, checking of operational and error states and for access to the datalogger. When using the GW Tool, the communication via Ethernet is enabled.
- Additionally, IQRF IDE can be used similarly as for the CK-USB-04(A): uploading the code into TR transceiver, configuration of TR module inside the GW, debugging of the application, using the IQMESH Network manager etc. In this mode the communication via Ethernet is disabled.

Internal web server

To get connected to the internal web server it is necessary to know IP address of the GW or the GW host name (if the network supports the NBNS, i.e. within the LAN only). Internal web server is used for GW configuration (manually in graphic environment or by loading a binary file *.gwcncfg), datalogger reading (TX, RX, System log), TR module programming (*.hex, *.iqrf, *.trcnfg) and FW upgrading (gweeth.hex). When uploading any of these files, it is necessary to have SD card plugged in the GW card slot, otherwise the operation can not be completed.

GW configuration



GW configuration is possible via internal www server, IQRF IDE or (especially for troubleshooting) via SD card.

SD card file structure

The SD card is intended for development, service and maintenance. It should be accessed primarily by the GW while direct writing by the user (externally by a standard SD card reader/writer) is recommended for exceptional purposes only. The standard way to perform required changes is using the internal web server.

The SD card uses the following folders:

- Root The root directory is intended for a new FW (`gweth.hex` file) to be used for upgrade.
- TRUPLOAD The folder intended for files to be uploaded into the TR module (`*.hex`, `*.iqrif`, `*.trcnfg`).
- GWCNFG The folder intended to record a new GW configuration (`*.gwcncfg`).
- BACKUP The folder intended for current GW configuration (`gw.gwcncfg`).

When using the web server, all folders and files are created automatically when required. In case of external direct writing the required folders must be created by the user. Files not necessary any more are automatically deleted after the usage.

System log

All important events are logged. System logs can be read using IQRF IDE GW Tool or the GW web interface.

Date and time

GW-ETH-02A contains a real time clock/calendar (RTCC). Date and time are synchronized using SNTP/Cloud server.

TR module data exchange

Data between the internal TR module and the GW memory is transferred bidirectionally via SPI (using the `bufferCOM` memory array inside the TR module). Therefore, the application in TR must have the SPI communication activated. When using DPA, **a hardware profile with SPI interface must be uploaded in TR**. Such plug-in is uploaded from the factory. The maximum SPI packet length is 64 B.

Ethernet services

- HTTP client for communication with IQRF Cloud server (using the 128 b AES encryption)
- HTTP server offering web pages for remote management via a common browser
- HTTP client for getting and updating of public address from DDNS
- UDP server/client for communication with IQRF network and for remote GW management
- SNTP client for getting date and time from time server
- ICMP server allowing “ping” to GW from a remote host
- DHCP client for automated getting of IP address from the DHCP server
- NBNS server for using names instead of IP addresses within the LAN

GW identification

MAC address

Every device has a unique MAC address in the format 00 1F D5 xx xx xx, where:

- 00 1F D5 is the OUI dedicated to MICRORISC s.r.o.
- xx xx xx is a device serial number

Actual MAC address is printed on the label at the bottom of the GW-ETH-02A case.

ID

Another unique number (manufacturer's identification) used to identify the gateway by IQRF IDE, the IQRF Cloud server and user applications utilizing the Cloud via API.

For GW-ETH-02A: ID = 12 xx xx xx, where xx xx xx are last 6 digits of the MAC address.

NBNS Name

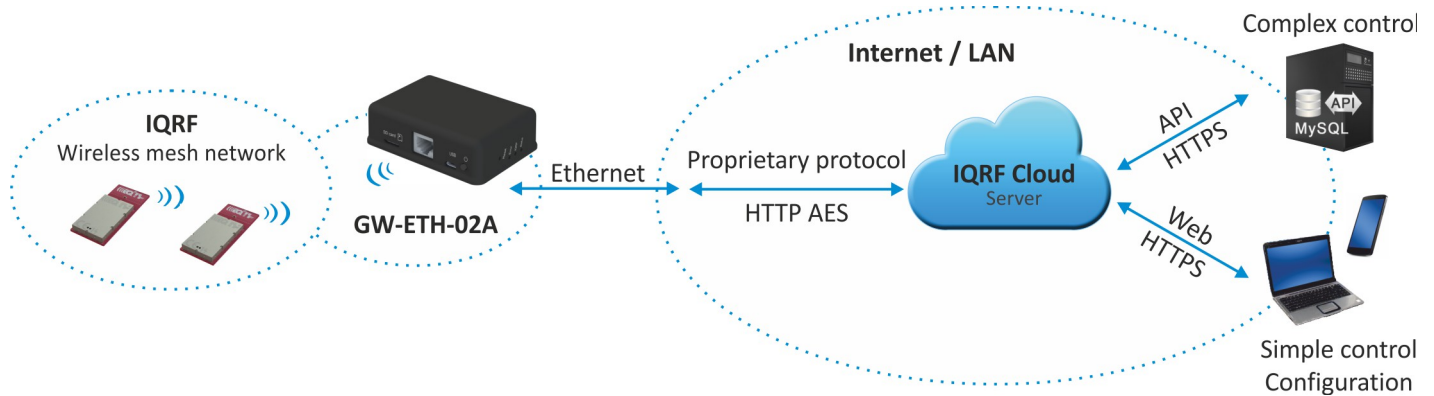
iqrif_XXXX, where XXXX are the last 4 digits of the MAC address.

IQRF Cloud

The IQRF Cloud provides an effective way to exchange data between IQRF wireless device(s) and a user superordinary system implemented by a higher level platform (e.g. PHP, JavaScript or web interface) and connected via Internet or a LAN.

As an interface to IQRF, the GW-ETH-02A or another IQRF gateway providing Internet connectivity (Ethernet, GPRS or WiFi) is intended.

An IQRF Cloud server is available free of charge on [http\(s\)://cloud.iqrf.org](http(s)://cloud.iqrf.org) provided by CIS (Complete Internet Services, s.r.o., an IQRF contractual partner for cloud solutions). Moreover, a licensed version is available for every user of an IQRF gateway preferring to implement and operate one's own IQRF Cloud. Refer to the IQRF Cloud User's Guide for details.



IQRF IDE – GW Tool

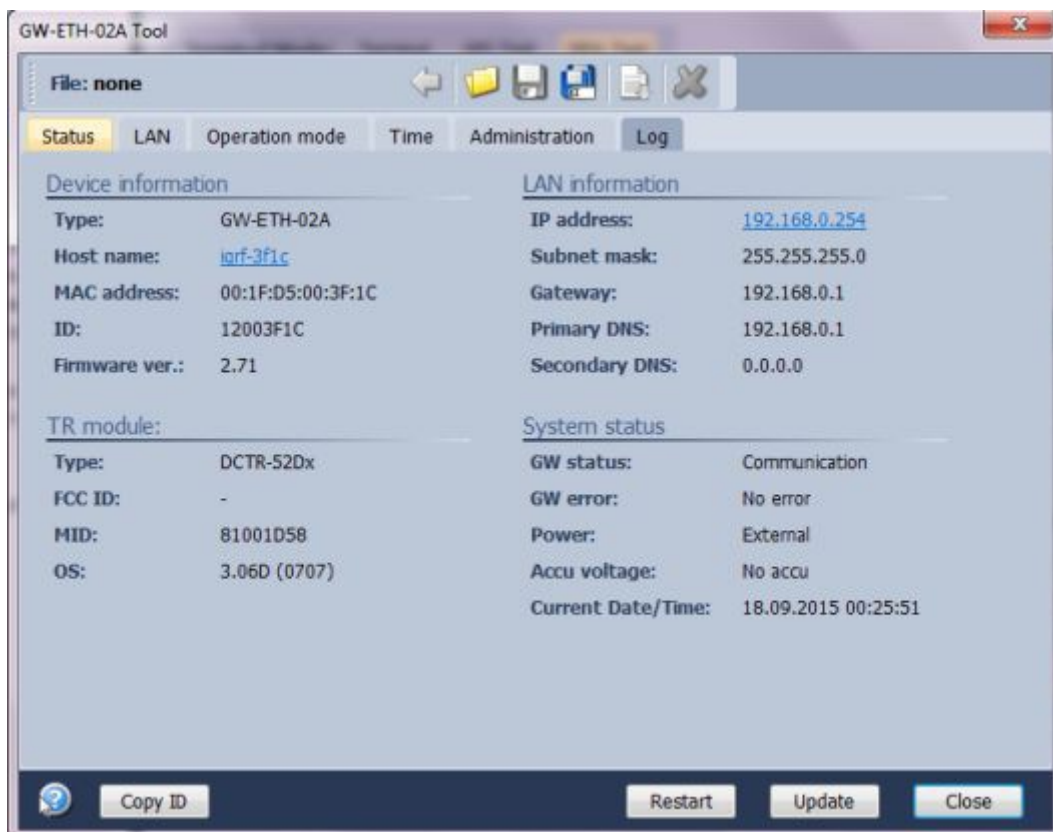
IQRF IDE 4.20 and higher is required.

Login to GW Tool

The GW Tool can be invoked from IQRF IDE menu Tools → GW Tool.



To open the Tool, the username and the password must be entered. Default values are `iqrif` and `iqrif`.

Status

The *Status* tab contains general overview about the gateway status. Several buttons are available to control the GW:

- Copy ID To copy the GW ID to the clipboard
- Restart To restart the gateway
- Update To update the Status tab
- Close To close the GW Tool window

Device information

- Type Current GW type
- Host name Name identification of GW in Ethernet network (used by NBNS)
- MAC address Globally unique identification of GW – Ethernet interface
- ID Unique identification number of the gateway
- Firmware ver. Current firmware version

TR module

- Type IQRF TR module type inside the gateway
- FCC ID FCC certification identification
- MID Unique IQRF TR module identification number
- OS IQRF OS version of the TR module

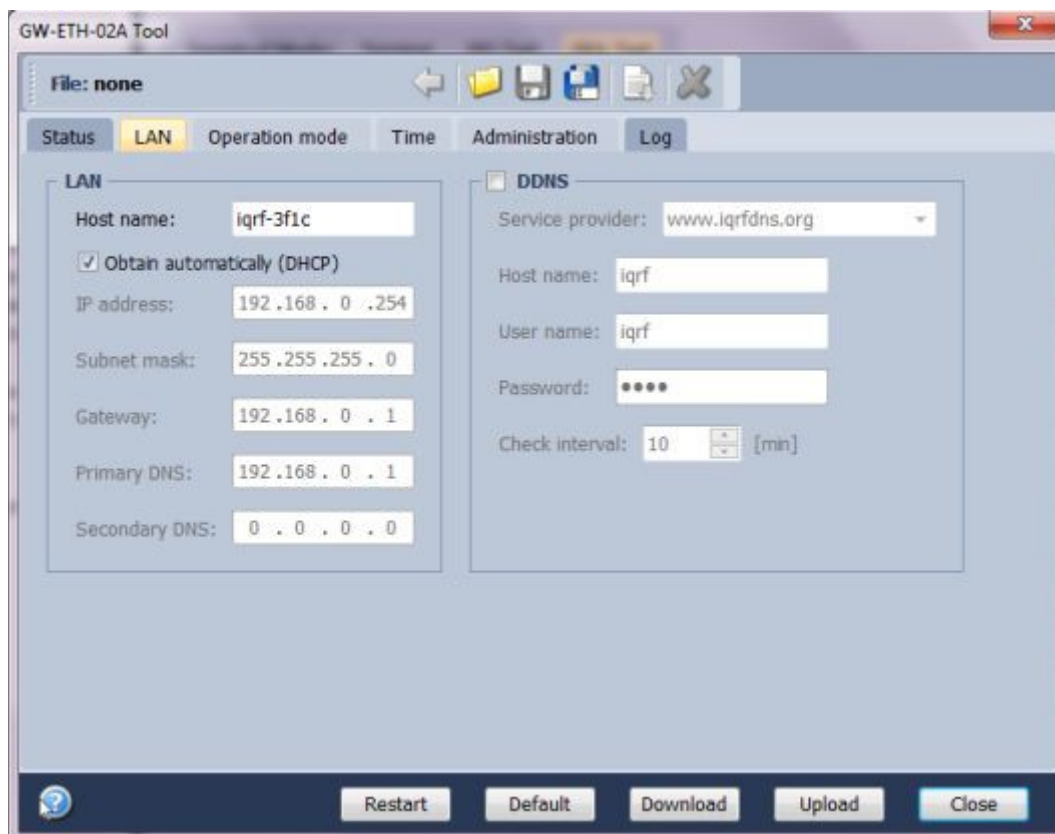
LAN information

- IP address Current IP address of the GW
- Subnet mask Ethernet network address range
- Gateway Main gateway/server of the Ethernet network
- Primary DNS Primary server with DNS service
- Secondary DNS Secondary server with DNS service

System status

- GW status Current operation executed by the gateway:
 - Communication
 - Cloud Server Communication
 - Error
- GW error An error during execution indication:
 - No Error
 - TR SPI Error
 - LAN Error
 - Cloud Server Error
 - SD Card Error
- Power „External“ – irrelevant for GW-ETH-02A
- Accu voltage „No accu“ – irrelevant for GW-ETH-02A
- Current Date/Time The date and time used in the gateway

LAN



The following buttons are available in addition to previous ones:

- Restart To restart the GW with current configuration
- Default To restore the default configuration
- Download To read the configuration from GW
- Upload To store the configuration to GW

LAN

It allows to set/get the parameters relating to Ethernet connection.

- Host name Name identification of GW in the Ethernet network (used by NBNS). If the main gateway/server offers NBNS service, it is allowed to use this host name instead IP address of GW
- Obtain automatically (DHCP) If the main gateway/server offers DHCP service, it is allowed to get all LAN parameters automatically (IP address, Subnet mask, Gateway, Primary DNS, Secondary DNS)
- IP address Current IP of the GW
- Subnet mask Ethernet network address range
- Gateway Main gateway/server of the Ethernet network
- Primary DNS Primary server with DNS service
- Secondary DNS Secondary server with DNS service

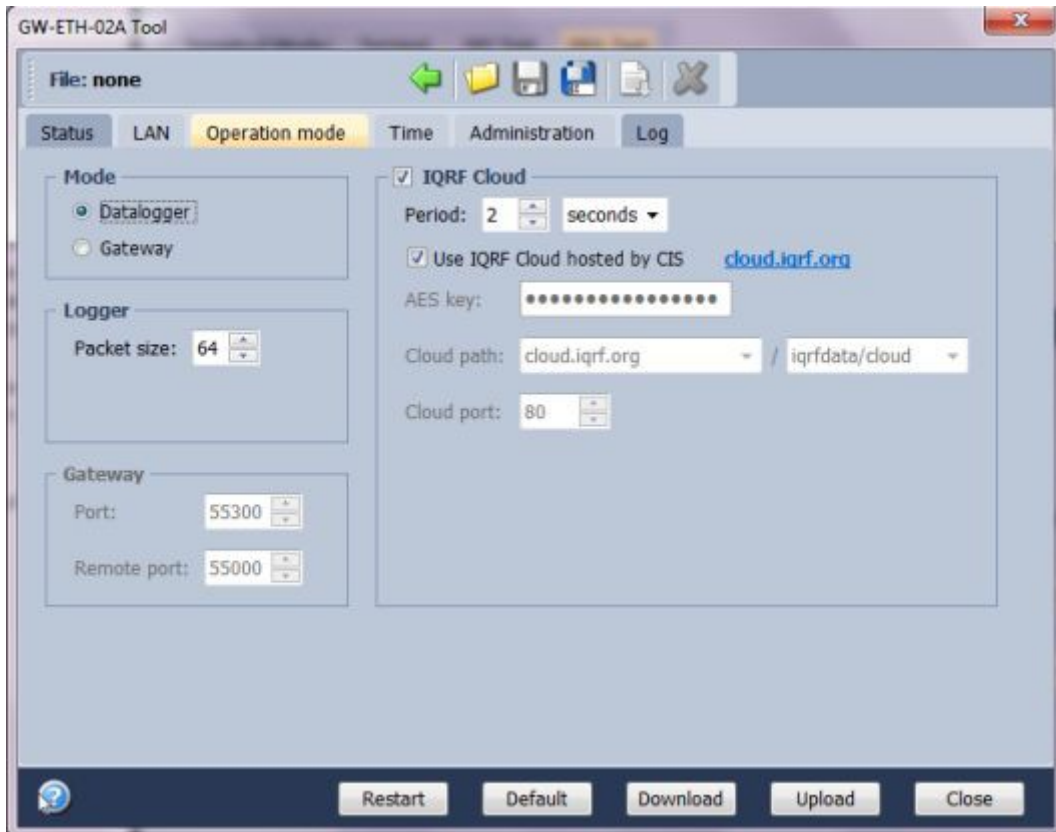
DDNS

DDNS service allows to get public address of network which the GW is assigned in. GW communicates with the DDNS server in checking interval and transmits its current IP address.

- For IQRF DNS:
The user or user application reads the IP address from the service provider server using the ID of the GW.
- For other DDNS servers:
The user or user application accesses the GW using the Host Name. Refer to the website of given server.
- DDNS DDNS service activation
- Service provider List of supported DDNS servers
- Host name Name identification of GW within DDNS
- User name DDNS account username
- Password DDNS account password
- Check Interval Communication period between the GW and DDNS server

Operation Mode

The *Operation mode* tab provides the setting of the gateway.



Mode

- Datalogger The datalogger is active. Its content can be read using IQRF Cloud server (if enabled), GW web server or IQRF IDE GW Tool.
- Gateway UDP channel is active. It is direct connection to the GW (without IQRF Cloud) using the application protocol described in chapter *Application protocol*. Communication ports can be selected in the *Gateway* field - *Port* and *Remote port*.

Logger

- Packet Size The size dedicated for the data log in the gateway memory. By default, this value is set to 64 B, the same as the maximum size of the IQRF packet. Shorter packets allow to store more data logs. Minimum packet size is 1 B. When an IQRF packet oversizes the selected packet size, a part of user data is lost.

When the packet size is changed the content of internal memory is cleared.

IQRF Cloud

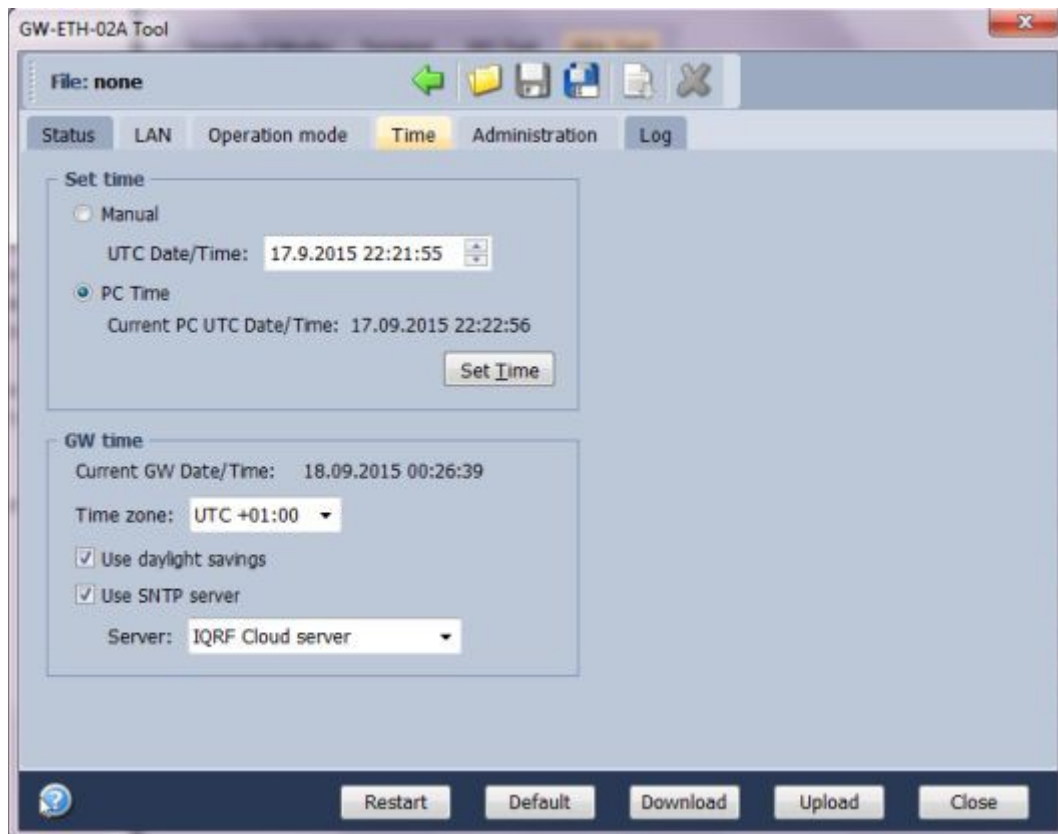
- Period Defines how often the gateway transmits the data to IQRF Cloud server. Allowed values are from 2 s to 24 hours.
- Use IQRF Cloud hosted by CIS The gateway is configured by default to communicate with IQRF Cloud server provided by CIS. Any gateway can also communicate with another IQRF Cloud server provided by anyone else. In such a case, the checkbox must be unchecked and the following fields must be filled.
- AES key Encryption key used for secure communication between the gateway and the IQRF Cloud server. The same key must also be specified at the server side.
- Cloud path The URL address where IQRF Cloud server is hosted. The `'/cloud'` substring must follow
- Cloud port The TCP port used. In most cases port 80 is used.

Gateway

- GW Port UDP port for the GW side.
- Remote port UDP port for a remote device side.

Time

GW time and date setup.



Set time

- Manual To setup the time manually
- PC time To upload the date and time from connected PC.

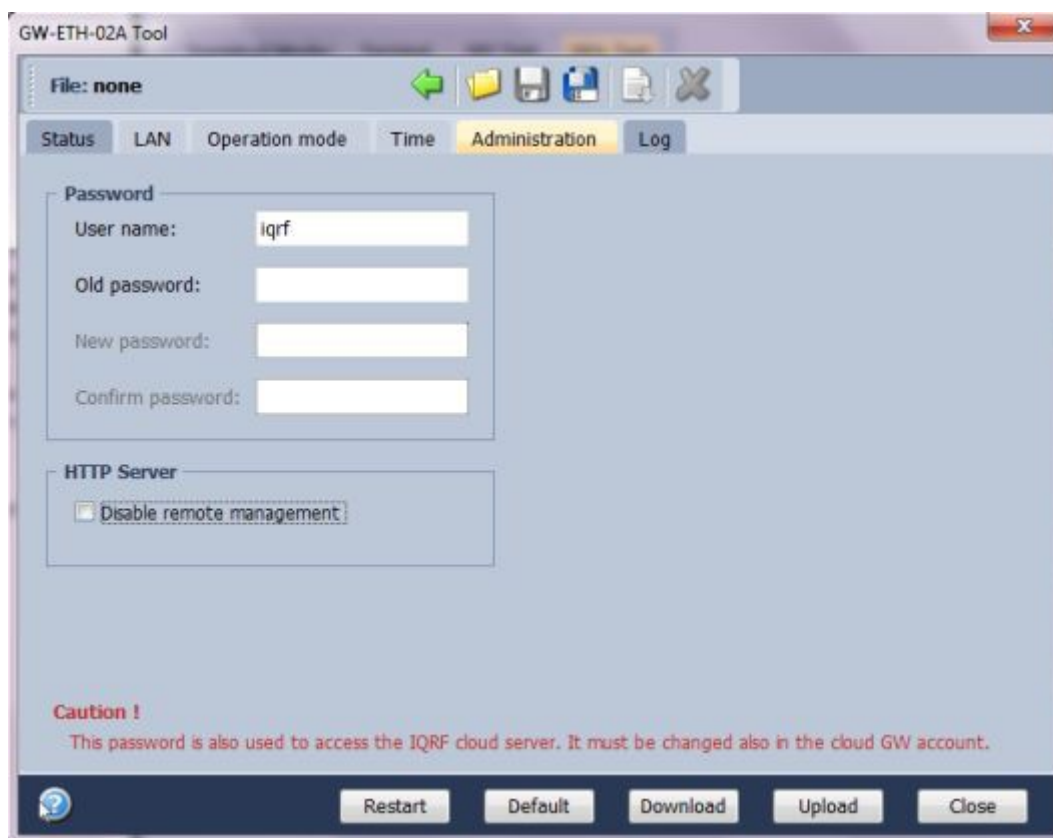
Selected time is transferred to the GW by the *Set Time* button.

GW time

- Current GW Date/Time Date and time currently running in the GW
- Time zone Time zone selection
- Use daylight savings Daylight savings for given time zone selection
- Use SNTP server When activated, the GW time will be synchronized with specified SNTP server time once per 6 hours.
- Server SNTP server selection. IQRF Cloud server is also available for this.

Administration

The user can change the username and the gateway password here. When the password is changed, in order to allow an access the data on the Cloud server it must be changed there too. The change of username has no effect for that. Allowed password length is from 4 to 8 characters. When the username or the password is lost, the user can reset the gateway to factory settings. The default username and password values are `iqrif` and `iqrif`.



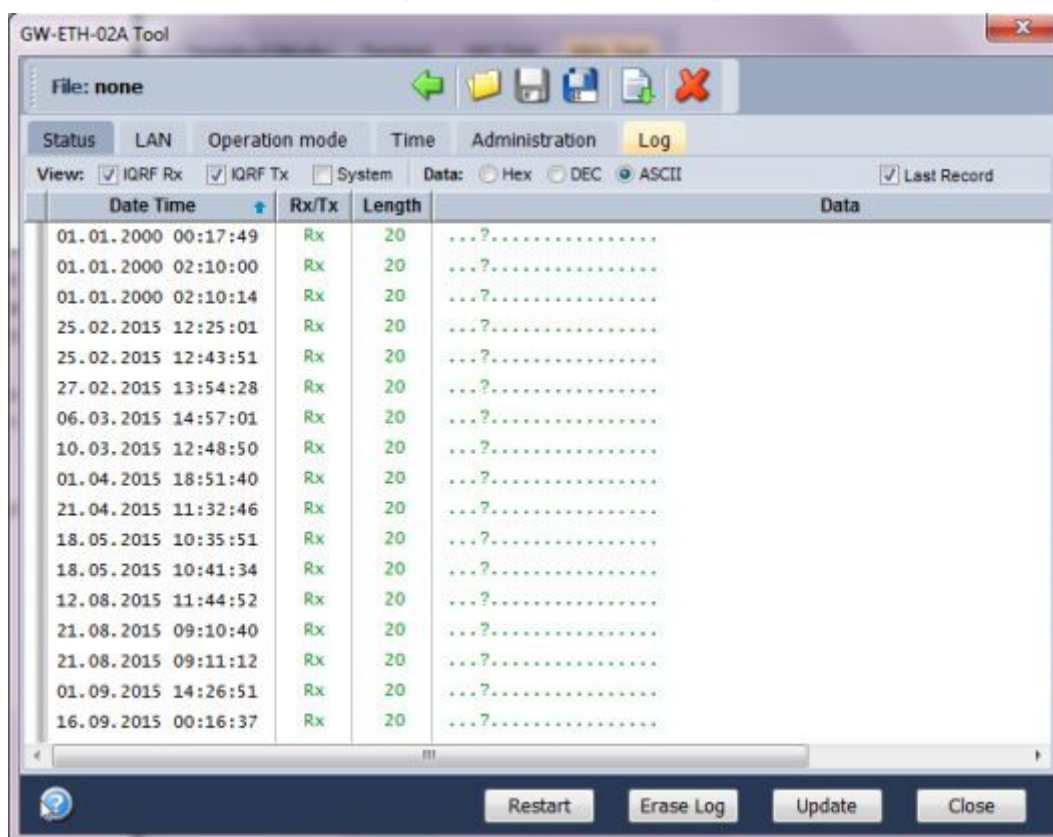
HTTP Server

- Disable remote management

Internal web server inside the GW can be disabled. The change takes effect after GW reset. The configuration through IQRF IDE – GW Tool is possible even if this option is disabled.

Log

Transmitted data stored on the Cloud server stays also accessible directly in the GW buffer.



Buttons:

- Restart To restart the GW
- Erase Log To erase the content of the whole GW internal log memory
- Update To read the data from the GW and refresh the *Log* window
- Close To close the *GW Tool* window

Three types of logs are stored in the gateway:

- IQRF Rx Data received from IQRF network and transmitted to the Cloud server
- IQRF Tx Data downloaded from Cloud server and transmitted to IQRF network
- System Certain events that occurs during the execution. The user do not usually need to take care about it. Nevertheless it can be helpful in case of nonstandard behavior.

Last Record When selected, the output list is scrolled down to display the last acquired data.

The format of IQRF RX/TX data depends on the user application in TR (e.g. DPA or any user-specific protocol). The format of system log is fixed. It contains the following information:

The following system events are logged:

- GW_ON_BY_EXT_POWER_ON
- GW_RESET_FOR_NEW_SETTINGS
- GW_LAN_ERROR
- SD_CARD_ERROR
- CLOUD_REGISTRATION_DONE
- CLOUD_LICENSE_DONE
- CLOUD_CONNECTION_ERROR
- CLOUD_REGISTRATION_ERROR
- CLOUD_UPLOAD_ERROR
- CLOUD_DOWNLOAD_ERROR
- CLOUD_DOWNLOAD_CONF_ERROR
- CLOUD_SYSTEM_PACKET_ERROR
- CLOUD_UNKNOWN_PACKET_RECEIVED
- CLOUD_LICENSE_ERROR
- TR_SPI_ERROR

Web server

The web server inside the GW is primarily intended for GW configuration and for local reading out from the datalogger. To access the web server, the IP address of given GW must be known. When accessing from a local network, the domain name 'iqrif_XXXX' (where XXXX are last 4 digits of the MAC address) can be used instead of the IP address. Both GW user name and the GW password are preset to 'iqrif' from the factory. Every page of the web server has a help.

It is recommended to change the user name and it is required to change the GW password as soon as possible, just after the first login to the web server.

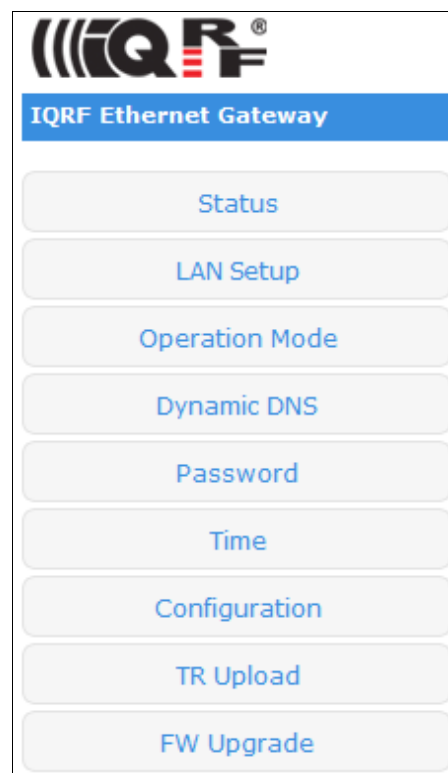
Web server can be enabled/disabled in IQRF IDE GW Tool/Administration.



Menu

The main menu provides an access to the configuration pages of GW.

- *Status* page shows information about the device, current network connection and the GW status.
- *LAN Setup* page allows to select the network connection parameters.
- *Operation Mode* page allows to select GW mode which GW works in.
- *Dynamic DNS* page allows to configure Dynamic DDNS service used to find the public IP address of the GW.
- *Password* page allows to change the access parameters for the Web server, Cloud server and IQRF IDE.
- *Time* page allows to set the time and date manually or to activate automatic time synchronization with the selected time server.
- *Configuration* page allows to write / read the GW configuration binary file *.gwcncfg.
- *TR upload* page is used to program the TR module.
- *FW upgrade* page allows to upload a new firmware.



Status

Device information

Type:	GW-ETH-02A
Host Name:	iqrif_3fd8
MAC Address:	00:1F:D5:00:3F:D8
ID:	12003FD8
Firmware Version:	2.47 (Nov 7 2014)

- **Type** GW type
- **Host Name** Name identification within local network (using this name instead of IP address), in the networks where NBNS is supported
- **MAC Address** Globally unique identification of GW device within Ethernet networks
- **ID** Unique identification of the gateway within the MICRORISC product line
- **Firmware Version** Current firmware version (and build date)

LAN information

IP Address:	192.168.1.125
Subnet Mask:	255.255.255.0
Gateway:	192.168.1.254
Primary DNS:	192.168.1.254
Secondary DNS:	0.0.0.0

The network connection parameters set manually or obtained through DHCP.

TR module

Type:	DCTR-52Dx
MID:	810006C4
OS:	3.05D (06B5)
Status:	Communication

- **Type** TR module type inside the GW
- **MID** Unique IQRF TR module identification number
- **OS** Current version of IQRF OS (and build version) of TR module
- **Status:** The state which the TR module is in

System status

GW Status:	Cloud Server Communication
GW Error:	No Error
Power:	External
Accu Voltage:	No accu
Current Date/Time:	07/11/2014 09:14:14 Fri

- **GW Status** Current operation executed by the gateway. See chapter *System status* above.
- **GW Error:** Indicates whether there is an error during execution
- **Power** Power supply type
- **Accu Voltage** Not intended for GW-ETH-02A
- **Current Date/Time** Current time of RTCC inside the GW

LAN setup

On this page it is possible to change the name (*Host Name*) for access to the GW which can be used within a local network instead of the IP address. If the DHCP service is available in the network, the *Obtain automatically* checkbox should be activated, otherwise the parameters for access to the LAN network must be selected manually.

In the factory settings, these parameters are obtained automatically from the network using DHCP.

Host Name:	<input type="text" value="iqr_3f02"/>
	<input checked="" type="checkbox"/> Obtain automatically
IP Address:	<input type="text" value="192.168.1.125"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>
Gateway:	<input type="text" value="192.168.1.254"/>
Primary DNS:	<input type="text" value="192.168.1.254"/>
Secondary DNS:	<input type="text" value="0.0.0.0"/>
<input type="button" value="Save"/>	

Operation mode

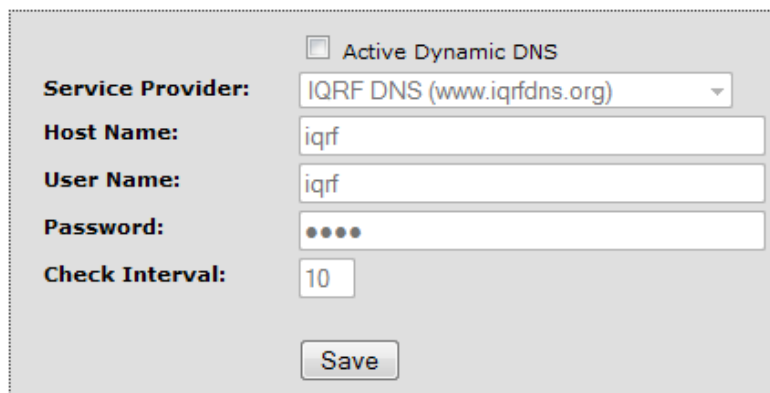
Mode:
☒ Datalogger
☐ Gateway

Packet Size:

☒ IQRF Cloud Enabled
Period:
☒ Use IQRF Cloud hosted by CIS
AES Key:
Cloud Path:
Cloud Port:
GW Port:
Remote Port:

- **Mode** *Datalogger Mode* activates storing data from IQRF network. This data can be read at the *Data Interface* page, by the Cloud server (if the communication with the Cloud server is enabled) or using IQRF IDE.
Gateway mode enables communication via UDP channel between the GW and a remote system according to the documented application protocol.
The default setting is Datalogger mode.
- **Packet Size** The size of the user data in IQRF packets. By selecting a smaller value is possible to store a larger number of packets. If the actual IQRF packet is longer, the remaining data is not saved.
- **IQRF Cloud Enabled** Activates the communication with the Cloud server
- **Period** Communication period which GW uploads/downloads data to/from the Cloud server in. Every digit of the double-figure number is set separately.
- **Use IQRF Cloud hosted by CIS** Allows to utilize the ready-to-use IQRF Cloud server hosted by CIS.
- **AES key** Encryption key used for the first connection to the Cloud server
- **Cloud Path** The URL address where IQRF Cloud server is hosted. The '/cloud' substring must follow
- **Cloud Port** The TCP port used. In most cases port 80 is used.
- **GW Port** UDP port for the GW side.
- **Remote port** UDP port for a remote device side.
- **Save** The button to confirm changes and close the window.

Dynamic DNS



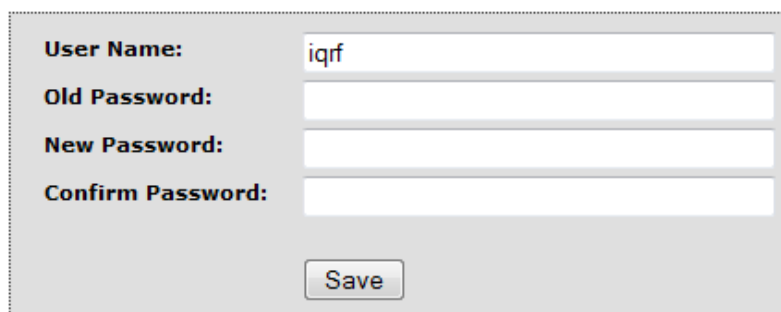
☐ Active Dynamic DNS
Service Provider: IQRF DNS (www.iqrfdns.org) ▼
Host Name: iqrfdns.org
User Name: iqrfdns.org
Password: ●●●●
Check Interval: 10

- **Active Dynamic DNS** Activates the GW - DDNS server communication. In the factory settings the DDNS is inactive.
- **Service Provider** DDNS service provider selection
- **Host Name** Name identification of the GW within DDNS
- **User Name** Username for DDNS account
- **Password** Password for DDNS account
- **Check Interval** Communication period between the GW and the Service provider server (in minutes). Minimum value is 10 minutes.

Password

In factory settings the User Name and the Password are "iqrfdns". The password should be changed by the user on the *Password Setup* page. To accomplish a change, the original password and the new one must be stated. For security, the new password must be typed two times.

When the password is forgotten, the factory settings of the GW must be restored by the Control pushbutton (see chapter *Pushbuttons* above). Then the factory preset username and password are restored.



User Name: iqrfdns
Old Password:
New Password:
Confirm Password:

Time

Current Date/Time: 08/10/2014 16:07:52 Wed

☐ **Manual**

Time (hh:mm:ss): : :

Date (dd/mm/yy): / /

☒ **SNTP Client**

Time Server:

Time Zone:

☒ Use Daylight Savings

The *Time Setup* allows to set the time of the internal clock measured by the GW. The time is required especially for the datalogger. Individual logs are provided with time stamps. The time can be setup manually or via the SNTP service. The SNTP provides periodical time synchronization from one of selected time servers. As a time server, the IQRF Cloud server can be used as well. In the factory settings the time and date are synchronized with the IQRF Cloud server.

Configuration

File: factory_DDNSnoip_MODEdl.gwcnfg

This page allows to upload the binary configuration file `*.gwcnfg` or generate this file based on the current GW settings. This type of file can be also generated by IQRF IDE GW Tool.

TR upload

File: GeneralHWP-Coordinator-SPI-V201-140602.iqrf

This page allows to reprogram the TR module inside the GW. Supported files are `*.hex`, `*.iqrf` and `*.trcnfg`. `*.trcnfg` can be generated by export of TR configuration in IQRF IDE.

FW Upgrade

File: gweth.hex

This page allows to upgrade the GW by a new firmware (file `gweth.hex`) which may be released by IQRF manufacturer and available on the product web page. See chapter *FW upgrade – Bootloader* below.

Factory setup

This initial setup can be restored whenever the control button is pressed for more than 10 s. This can be useful if it is not possible to establish communication due to wrong configuration.

LAN -----

- NBNS name „iqrif_“, where are last 4 digits of the MAC address.
- Get IP address from DHCP server automatically
- IP address 192.168.0.254
- Subnet mask 255.255.255.0
- Gateway 192.168.0.1
- Primary DNS server: 192.168.0.1
- Secondary DNS server 0.0.0.0

Operation Mode -----

- Mode Datalogger
- Packet Size 64B
- IQRF Cloud Communication Enabled
- Use IQRF Cloud Server hosted by CIS Enabled
- Communication period 10 s
- GW port for the application protocol 55300
- Host port for the application protocol 55000

Dynamic DDNS -----

- Dynamic DNS Disabled

Password -----

- Authorization when enter the internal web server page, IQRF Cloud server or IQRF IDE GW Tool
 - Username „iqrif“
 - Password „iqrif“

Time -----

- Getting date and time from the time server On
- Time server IQRF Cloud server
- Summer / winter time distinguishing On
- Time zone GMT+01:00

HTTP Server -----

- Disable remote management Off

First startup

Factory settings

GW-ETH-02 is set from the factory as follows:

- User name iqrif
- Password iqrif
- Operation mode Datalogger
- IQRF Cloud Enabled
- IQRF Cloud hosting By CIS (<https://cloud.iqrf.org>)
- Communication period 10 s

This setting can be used to operate the GW with IQRF Cloud without any changes in configuration. But it is strictly recommended to change the GW password to avoid illegal access to GW data.

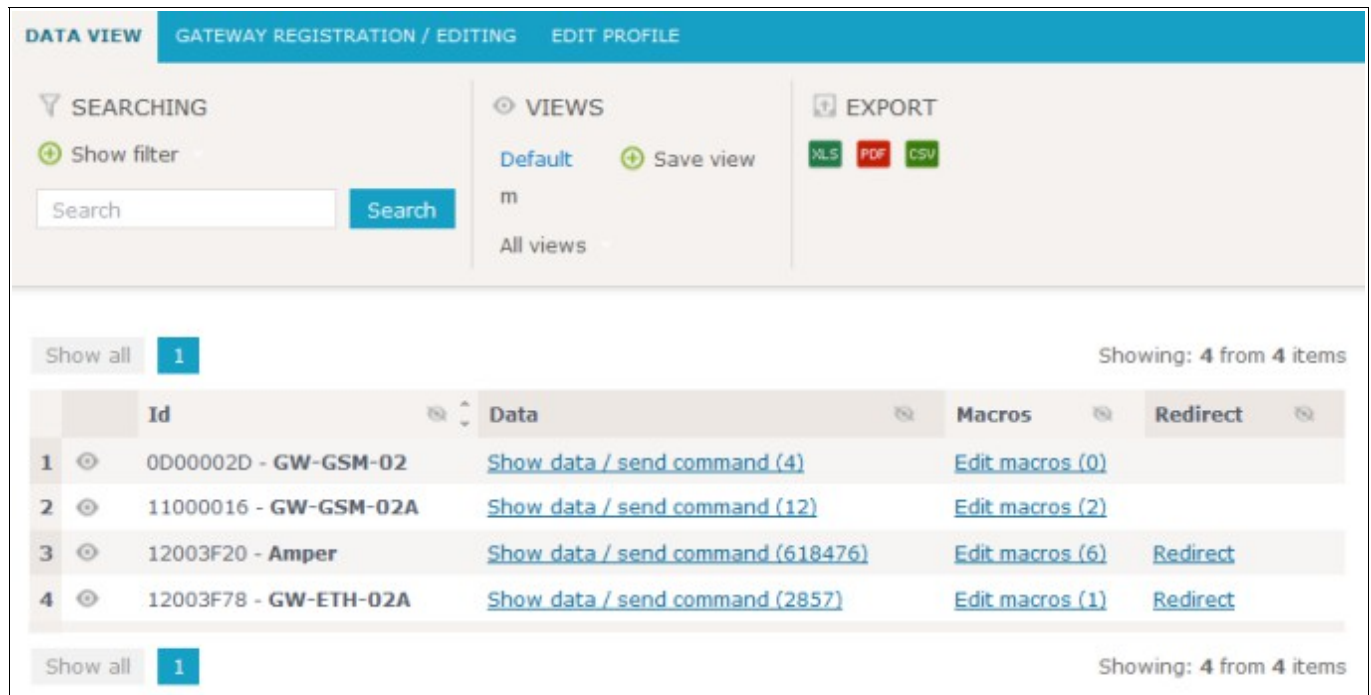
Step by step guide

To get familiar with GW-ETH-02A functionality, the GW can be used with DPA hardware profile in similar way as which is described in IQRF DPA Quick Start Guide:

- Follow this Guide, chapters 1 to 5.
- Use GW-ETH-02A instead of CK-USB-04(A)
- GW-ETH-02A is delivered with the `GeneralHWP-Coordinator-STD-SPI` plug-in uploaded in internal TR module. Thus, there is no need to upload any HWP plug-in.
- After LED control testing from IQRF IDE via USB according to chapter 5 mentioned above, test the same commands via Ethernet:
 - Disconnect the GW from IQRF IDE or go to IQRF IDE GW Tool.
 - Open the <https://cloud.iqrf.org> page in web browser



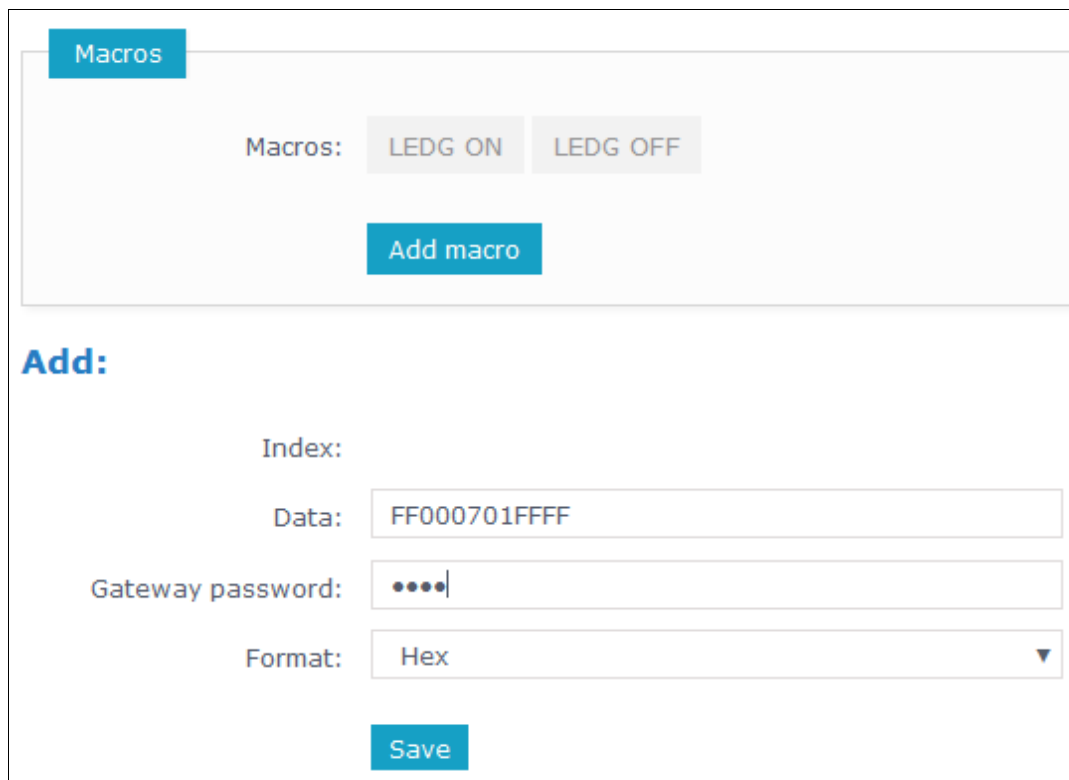
- Create your user account there and login to this



The screenshot shows the 'GATEWAY REGISTRATION / EDITING' section of the IQRF web interface. It includes a search bar, view options (Default, Save view), and export options (XLS, PDF, CSV). Below these is a table of registered gateways with 4 items shown.

	Id	Data	Macros	Redirect
1	0D00002D - GW-GSM-02	Show data / send command (4)	Edit macros (0)	
2	11000016 - GW-GSM-02A	Show data / send command (12)	Edit macros (2)	
3	12003F20 - Amper	Show data / send command (618476)	Edit macros (6)	Redirect
4	12003F78 - GW-ETH-02A	Show data / send command (2857)	Edit macros (1)	Redirect

- Add the GW to the List of gateways assigned to your account by the *Add gateway* button. The GW ID and the password must be entered.
- Open the main page of the GW by clicking to the GW ID number
- Click the *Send data to IQRF* button. The window with predefined LED control commands opens.



The screenshot shows the 'Macros' configuration window. It has a 'Macros' tab and a list of macros: 'LEDG ON' and 'LEDG OFF'. Below the list is an 'Add macro' button. The 'Add:' section contains fields for 'Index:', 'Data:' (with value 'FF000701FFFF'), 'Gateway password:' (with masked input), and 'Format:' (set to 'Hex'). A 'Save' button is at the bottom.

- Using the macros or by modification of commands in *IQRF Tx* field and the *Send* button you can control LEDs in individual or all nodes similarly as before (by using IQRF IDE).

Application protocol for UDP channel

The communication is realized with the application protocol described below. It uses the transport protocol UDP according to the OSI reference model. For establishing a connection it is necessary to know the UDP port where the GW is listening and its IP address or the NetBIOS name (Host Name).

GW answers and response to commands to any asking device. Asynchronous messages are sent to broadcast address until the communication is established. After communication establishing the messages are sent to address of the last communicating host. Thus, more hosts (e.g. servicing programs on more PCs) can communicate with the GW.

If the IP address or NetBIOS of the GW and the port number are known it is just possible to establish the connection. Otherwise the request for a GW identification can be sent to broadcast address (in a single LAN segment only – routers filter packets with broadcast addresses.) All GWs receiving this request will answer which allows to get actual IP address of given GW.

Packet description

The packet structure is the same for both communication directions:

HEADER (H = 9 B)	DATA (D = 0 – 497 B)	CRC (2 B)
------------------	----------------------	-----------

For receiving, GW checks:

- GW_ADR validity – see the packet header
- packet length must not be lower than HEADER + CRC
- packet length must not be higher than HEADER + DATA MAX + CRC
- CRC

Header

Packet header has a fixed length:

0	1	2	3	4	5	6	7	8
GW_ADR	CMD	SUBCMD	RES	RES	PACID_H	PACID_L	DLEN_H	DLEN_L

GW_ADR	identification address of the equipment of the GW-ETH-02A type (value: 0x22)
CMD	command of a packet (values: 0x01 ... 0x7F)
	answer to given command: CMD = CMD 0x80 (bit 7 of given CMD set)
SUBCMD	auxiliary information of a command (values: see description below)
RES	reserved
PACID_H	packet identification – upper byte (values: 0x00 ... 0xFF)
PACID_L	packet identification – lower byte (values: 0x00 ... 0xFF)
DLEN_H	data length – upper byte (values: 0x00, 0x01)
DLEN_L	data length – lower byte (values: 0x00 ... 0xFF)

The packet identification (PACID) can be any number 0x0000 – 0xFFFF according to the host specification. The GW always copies this number to the answer to given packet.

CRC

The check part has a fixed length:

H+D	H+D+1
CRC_H	CRC_L

CRC type	CRC-16-CCITT
Polynomial	0x1021 ($x^{16} + x^{12} + x^5 + 1$)
Initial value	0x0000

CRC is calculated from the HEADER and DATA parts.

Communication initiated by the host

Get GW identification

Getting a GW identification. It is intended to identification of the GW which the connection is established with.

host -> GW direction

CMD	0x01	returns the GW identification
SUBCMD	0x00	no information
DLEN	0x0000	no data

GW -> host direction

CMD	0x81	answer to the 0x01 command
SUBCMD	0x00	no information
	0x10	bootloader
DATA		text with GW identification. See Data identification

Get GW status

The GW returns the information about its state.

host -> GW direction

CMD	0x02	returns the GW status
SUBCMD	0x00	no information
DLEN	0x0000	no data

GW -> host direction

CMD	0x82	answer to the 0x02 command
SUBCMD	0x00	no information
DATA		see Status data

Write data to TR module

Data according the IQRF SPI protocol is written to the TR module. The answer is an acknowledge of writing to the module. If the answer is requested from the module it is sent with the actual command – see Communication initiated by the GW. According to GW configuration either just actual data or the whole packet is written.

host -> GW direction

CMD	0x03	write data to the TR module
SUBCMD	0x00	no information
DATA		data for the TR module

GW -> host direction

CMD	0x83	answer to the 0x03 command
SUBCMD	0x50	write OK
	0x60	write Error (number of data = 0 or more than TR buffer COM length)
	0x61	write Error (SPI bus busy)
	0x62	write Error (IQRF - CRCM Error)
DLEN	0x0000	no data

Write to RTCC in GW

Writing of time and date to the RTCC in GW

<i>host -> GW direction</i>		
CMD	0x08	write to RTCC
SUBCMD	0x00	no information
DB1		GW time – seconds (values see Time and data coding)
DB2		GW time – minutes
DB3		GW time – hours
DB4		GW data – day of week
DB5		GW data – day
DB6		GW data – month
DB7		GW data – year

<i>GW -> host direction</i>		
CMD	0x88	answer to the 0x08 command
SUBCMD	0x50	write OK
	0x60	write Error (invalid values)
DLEN	0x0000	no data

Change autentization

Changing of username and password for access to GW via www.

<i>host -> GW direction</i>		
CMD	0x09	change autentization
SUBCMD	0x00	no information
DB1		username: text
to		(max. 15 characters, not used ones replace with zeroes)
DB15		
DB16		old password: text
to		(max. 15 characters, not used ones replace with zeroes)
DB30		
DB31		new password: text
to		(max. 15 characters, not used ones replace with zeroes)
DB45		

<i>GW -> host direction</i>		
CMD	0x89	answer to the 0x09 command
SUBCMD	0x50	write OK
	0x60	write Error (invalid old password)
DLEN	0x0000	no data

Read TR Module Info in GW

Getting information about the module in the GW

<i>host -> GW direction</i>		
CMD	0x11	read the TR Module Info from the GW
SUBCMD	0x00	no information
DLEN	0x0000	no data

<i>GW -> host direction</i>		
CMD	0x91	answer to the 0x11 command
SUBCMD	0x00	no information
DATA		see Module Info

Reset GW (GW as well as the bootloader)

Remote GW reset (initialization).

host -> GW direction

CMD	0x12	GW reset
SUBCMD	0x00	no information
DLEN	0x0000	no data

GW -> host direction

See Communication initiated by the GW – Sending the GW status message.

TR module reset

Remote reset of the TR module.

host -> GW direction

CMD	0x13	TR module reset
SUBCMD	0x00	no information
DLEN	0x0000	no data

GW -> host direction

CMD	0x93	answer to the 0x13 command
SUBCMD	0x50	OK command
	0x60	Error command
DLEN	0x0000	no data

Sending a command not implemented in GW

host -> GW direction

CMD	?	unknown command
SUBCMD	?	arbitrary information
DATA		arbitrary data

GW -> host direction

CMD	? 0x80	answer to an unknown command
SUBCMD	0x60	packet error
DLEN	0x0000	no data

Communication initiated by the GW (asynchronous message)

Send data from TR module

Sends data from the TR module according to the IQRF SPI protocol. According to the settings either just actual data or the whole packet is send.

GW -> host direction

CMD	0x04	send data from TR module
SUBCMD	0x00	no information
DATA		data from TR module

Send GW status message

It is a message from the GW about its state. The information is indicated by the SUBCMD byte.

GW -> host direction

CMD	0x05	GW status message
SUBCMD	0x01	GW reset, sent after switching on
	0x02	change its own IP address (only if the DHCP is active)
DATA		text with GW identification. See Identification data.

Identification data

Identification data consists of several texts separated by 0x0D 0x0A.

1. - GW type e.g.: „GW-ETH-02A“
 2. - FW version e.g.: „2.50“
 3. - MAC address e.g.: „00 11 22 33 44 55“
 4. - TCP/IP Stack version e.g.: „5.42“
 5. - IP address of GW e.g.: „192.168.2.100“
 6. - Net BIOS Name e.g.: „iqr_“ 15 characters
 7. - IQR module OS version e.g.: „3.06D“
 8. - Public IP address e.g.: „213.214.215.120“
-

Status data

GW status data for the *Get GW status* command.

DB1	TR module status (see the IQR SPI protocol)
DB2	no used
DB3 0x01	supplied from external source
DB4	GW time – seconds (see Time and date coding)
DB5	GW time – minutes
DB6	GW time – hours
DB7	GW date – day of the week
DB8	GW date – day
DB9	GW date – month
DB10	GW date – year
DB11	no used
DB12	no used

Time zone coding

0x00	(GMT-12:00)	0x0B	(GMT-02:00)	0x16	(GMT+05:45)
0x01	(GMT-11:00)	0x0C	(GMT-01:00)	0x17	(GMT+06:00)
0x02	(GMT-10:00)	0x0D	(GMT)	0x18	(GMT+06:30)
0x03	(GMT-09:00)	0x0E	(GMT+01:00)	0x19	(GMT+07:00)
0x04	(GMT-08:00)	0x0F	(GMT+02:00)	0x1A	(GMT+08:00)
0x05	(GMT-07:00)	0x10	(GMT+03:00)	0x1B	(GMT+09:00)
0x06	(GMT-06:00)	0x11	(GMT+03:30)	0x1C	(GMT+09:30)
0x07	(GMT-05:00)	0x12	(GMT+04:00)	0x1D	(GMT+10:00)
0x08	(GMT-04:00)	0x13	(GMT+04:30)	0x1E	(GMT+11:00)
0x09	(GMT-03:30)	0x14	(GMT+05:00)	0x1F	(GMT+12:00)
0x0A	(GMT-03:00)	0x15	(GMT+05:30)	0x20	(GMT+13:00)

Time and date coding

For individual values the BCD code is used. The upper nibble (UN) means tens and the lower nibble (LN) means units.

Example (seconds):

DB = 0x53 means 53 s

Legal ranges:

seconds	UN = 0 – 5	LN = 0 – 9	min. 0	max. 59
minutes	UN = 0 – 5	LN = 0 – 9	min. 0	max. 59
hours	UN = 0 – 2	LN = 0 – 9	min. 0	max. 23
day	UN = 0 – 3	LN = 0 – 9	min. 1	max. 31
month	UN = 0 – 1	LN = 0 – 9	min. 1	max. 12
year	UN = 0 – 9	LN = 0 – 9	min. 8	max. 99 (2008 - 2099)
day of week	UN = 0	LN = 0 – 6	min. 0	max. 6 (0 – Sunday, 1 – Monday, ...)

These ranges are checked during writing to the GW. If out of range the packet with SUBCMD = *write Error* is returned.

Module Info data

Information about the TR module in the GW. See IQRF OS Reference guide, function `moduleInfo()` for description.

DB1	<code>bufferInfo[3]</code>
DB2	<code>bufferInfo[2]</code>
DB3	<code>bufferInfo[1]</code>
DB4	<code>bufferInfo[0]</code>
DB5	<code>bufferInfo[4]</code>
DB6	<code>bufferInfo[5]</code>
DB7	<code>bufferInfo[6]</code>
DB8	<code>bufferInfo[7]</code>

IQRF DNS

IQRF DNS server is provided by the MICRORISC s.r.o. and is intended as a replacement of the the Dynamic DNS server. It allows users a remote connection to an equipment (within Internet) without knowing current public IP address of the equipment. If the equipment is configured and local redirection is set properly, it is possible to use the IQRF DNS names instead of IP addresses of the equipment in web browsers - see the example below. The only thing what the user should know, is the MAC address of the equipment. In following explanation the MAC address 001FD5010203 and IP address 10.100.20.200 are used.

Registering the equipment in the IQRF DNS server database

<http://www.iqrfdns.org/?IDIP=001FD5010203>

The GW-ETH-02A client sends this command automatically and regularly (if this is activated in the GW setup) which keeps a record of MAC address of the equipment and corresponding IP address (for remote GW connecting) in the server database. The server responds with public IP address which the command was sent from. Thus, the equipment finds out its public IP address in the format:

Current IP Address: 10.100.20.200

Request for IP address

<http://www.iqrfdns.org/?IP=001FD5010203>

The http client of the GW-ETH Tool program sends this command to find out the IP address assigned to given MAC address in the server database. The server returns the result in the format:

Requested IP Address: 10.100.20.200

If the MAC address is not found in the database the server returns:

IQRFDNS Message: Requested device is not registered.

Connection to the equipment - redirection

<http://www.iqrfdns.org/?ID=001FD5010203>

The command is intended to be entered to the www browser for connection to www interface of the GW-ETH-02A. The server finds requested ID (MAC address) in the database and redirects it to assigned IP address. The GW must have set and activated the IQRF DNS server as the DDNS.

If requested ID is not found the server returns:

IQRFDNS Message: Requested device is not registered.

If there is no answer from the GW after redirection the server returns:

IQRFDNS Message: Device is not responding. It is either offline or its IP address has changed. Try it again after xx:xx min.

Firmware upgrade / Bootloader

GW-ETH-02A has the bootloader implemented to upgrade the FW by a new version released by the IQRF manufacturer (`gweth.hex` file). There are two ways for FW upgrade:

- Store the `gweth.hex` file to the SD card using the internal web server (via Ethernet). Then the GW performs reset automatically. See chapter *FW upgrade* above.
- Store the `gweth.hex` file to the SD card (in the root directory) externally (e.g. from PC using an SD card reader), insert the card into the GW and reset the GW.

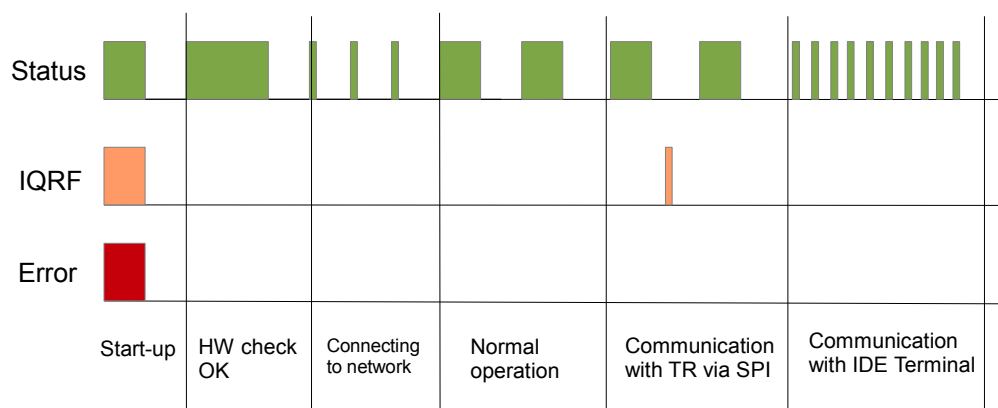
After the reset the upgrade procedure starts.

- If the upgrade is completed, the GW will then be started with the new FW version. To make sure that the upgrade passed successfully, check the current FW version e.g. via the internal web server.
- If the upgrade fails during the *FW checking* phase, the GW will then be started with the original FW version.
- If the upgrade fails during the *FW writing* phase, neither the original nor the new firmware is ready and the GW stays in the *Start-up* phase. Then, recovery is possible only by FW upgrade from SD card. The user should restore the `gweth.hex` file on the SD card before starting the recovery.

See chapter *LED indication (Firmware upgrade and Run operation)* for possible states.

Appendix 1 – LED indication

Run operation



- When the gateway is started-up all LEDs are on for 1 s.
If the GW is switched on by connecting the USB cable to PC with IQRF IDE running, the GW detection by IDE takes about 5 s.
- After the start up the gateway performs a check of its hardware. If there is no problem in HW, the green LED is on for 2 s.
- After HW check, the gateway is connecting to Ethernet/LAN (and to Cloud server, if enabled). This is indicated by short flashing of green LED, 100 ms on / 1 s off.
- When the GW is successfully connected the green LED flashes 500 ms on / 500ms off. The GW works in normal mode.
- When the gateway is connected to IQRF IDE Terminal, the communication over Ethernet is disabled (SPI communication is forwarded to the Terminal but not to the Cloud). This mode is indicated by short flashes of green LED, 100 ms on / 100 ms off.
- When the GW is connected to IQRF IDE GW Tool, the communication via Ethernet is not limited. The GW works in normal mode.
- When the GW communicates with TR module, orange LED flashes for 10 ms.

Start-up errors

After the start-up the GW performs hardware check. If there is a critical error prohibiting basic functionality, the GW goes to error state, see below. This is indicated by red LED permanently on.

Run errors

If the gateway is at least partially operable or if an error occurs during its operation it continues the execution and indicates the run error.



During run error red LED is continuously on. Green LED flashes with the specific duty:

- Run error 1 10 ms on, 1 s off
- Run error 2 100 ms on, 100 ms off
- Run error 3 500 ms on, 500 ms off

Run error 1

- Ethernet start error Ethernet interface fatal error
- Ethernet service error Some of Ethernet services failed
- Connection error Connection with IQRF Cloud server failed (in the Datalogger mode only)
- Registration error Registration to IQRF Cloud server failed (in the Datalogger mode only)
- Upload error Error when uploading data to IQRF Cloud server (in the Datalogger mode only)
- Download error Error when downloading data from IQRF Cloud server (in the Datalogger mode only)

When the gateway indicates Run error 1, it is not able to communicate with the Cloud server due to one of previous reasons, but it is still possible to receive and save data from IQRF side. To detect the Run error 1 type, the gateway must be connected to IQRF IDE with the Status tab opened where the error type can be read.

Run error 2

- IQRF SPI error IQRF TR module is not responding.

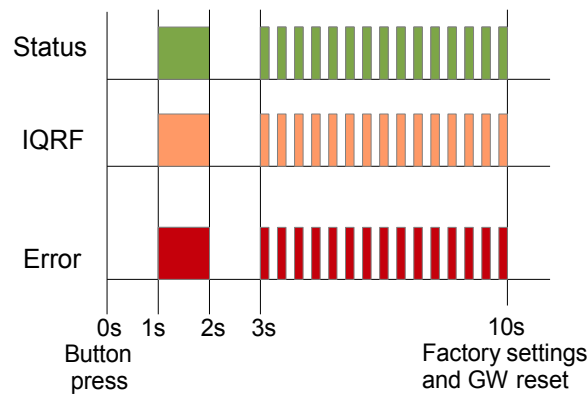
When the gateway signalize Run error 2, it is not able to communicate with the IQRF side, nevertheless the communication with IQRF Cloud server not affected

Run error 3

- SD card error

Factory setting and turning the GW off

To restore the setting from the factory or to switch the GW off, the following procedure should be applied:



Factory settings

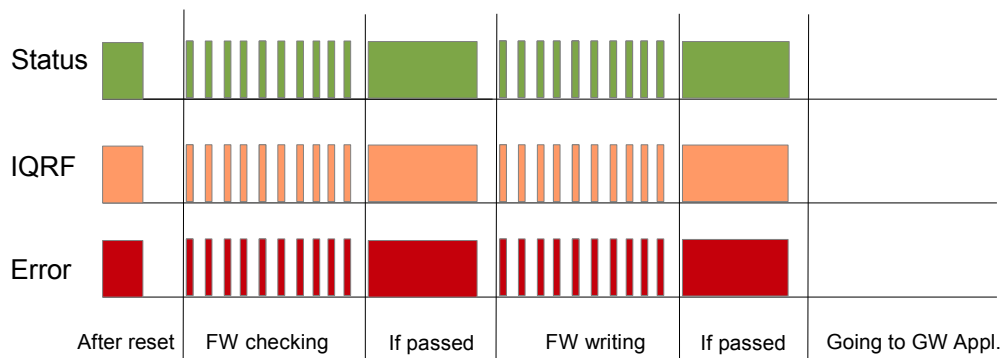
- At Time = 0 The user is pressing and holding the button.
- At Time = 1 to 2 s All LEDs are on.
- At Time = 2 to 3 s All LEDs are off.
- At Time = 3 s to 10 s All LEDs flashing 100 ms on, 100 ms .
- At Time = 10 s All LEDs are off, the GW factory setting is restored and the GW is reset.

Turning off

- If the button was released at time 0 s to 1 s, this procedure is canceled and the GW returns to run mode.
- If the button was released at time 1 s to 10 s, the GW is turned off.

Firmware upgrade

In the first step the stored hex file is checking for errors. If no errors occur the content of the hex files is written to the main MCU. Both of these events are indicated by 20 Hz synchronous flashing of all LEDs. If the hex file checking fails, the GW will be started with the original FW version. If the hex file writing is successful, the GW will be started with the new FW version.



Product information

Pack list

- GW-ETH-02A gateway
- Battery CR2032 inside
- TR module DCTR-72DA or DCTR-52DA inside, with GeneralHWP-Coordinator-STD-SPI hardware profile uploaded
- Power source TY-A6 (5V DC, 500 mA, with USB connector, compatible with cable CAB-USBABMICRO)
- MicroUSB cable CAB-USBABMICRO
- Ethernet cable, standard with RJ-45 8-pin connectors
- SD card

Ordering code

- GW-ETH-02A (72D) IQRF Ethernet gateway, DCTR-72DA inside
- GW-ETH-02A (52D) IQRF Ethernet gateway, DCTR-52DA inside

Firmware history

- v2.73 First release

Document history

- 150930 For firmware v2.73 and IQRF Cloud provided by CIS.
- 141219 For firmware v2.51.
- 141203 First release for firmware v2.50.

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Partners and distribution

Please visit www.iqrf.org/partners

Quality management

ISO 9001 : 2009 certified

Complies with directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).



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