

EWIO₂ Remote Control API

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1. Introduction

The communication between EWIO₂ and web interface is managed through HTTP over TCP/IP. The application layer that is transferred with HTTP can, however, also be used by other applications than a web browser.

Therefore, in principle any communication coming through a web interface can also be run with applications that use API.

In addition, general functions (as for SQL instructions) are available for additional functionality.

2. Principles of establishing communication

Each communication is protected with a TAN. It is therefore necessary to conduct a login procedure before the actual sending or receiving of user data. Within these, any number of communication steps (functions) are possible.

Communication steps:

Request ID

Login

Function 1

Function 2

...

Logout

3. Overview of functions

3.1. Administrative functions

3.1.1. Request session ID

The server generates a random ID that is sent to the client.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<pw-md5-hash>&type=session_id&module=login

Return: <Session ID>

3.1.2. Login

The client sends the MD5 hash of the concatenation of password and session ID (= tan-md5-hash) to the server. If the tan-md5-hash is correct, this server returns a LOGIN OK, otherwise a LOGIN ERROR.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=login&module=login

Return: LOGIN OK / LOGIN ERROR

3.1.3. Logout

If communication is ended on the client side, the client will send a logout to the server. Otherwise, the logout is initiated automatically by the server after 30 minutes without communication.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=logout&module=login

Return: LOGOUT OK

3.1.4. Reboot

If communication is terminated on the client side with a EWIO₂ reboot, the client sends a reboot to the server. After the return message is sent, the EWIO₂ is rebooted. After the reboot, a new session ID must be requested and the login procedure must be repeated.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password= <tan-md5-hash>&type=reboot&module=login

Return: REBOOT OK

3.2. General functions

3.2.1. Load file (text file)

The client requests a text file that is currently on the EWIO₂.

Method: GET

URL: <server-ip>/cgi-bin/getTxtFileFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=fileload&module=<Source address of file>

Return: <data contents>

3.2.2. Save file (text file)

The client sends a text file to the server.

Method: POST

URL: <server-ip>/cgi-bin/setTxtFileToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=fileload&module=<Target address of file>&data=<Data contents>

Return: -

3.2.3. Load file (binary file)

The client requests a binary file that is currently on the EWIO₂.

Method: GET

URL: <server-ip>/cgi-bin/getBinFileFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=fileload_bin&module=<Source address of file>

Return: <data contents>

3.2.4. Save file (binary file)

The client sends a binary file to the server.

Method: POST
URL: <server-ip>/cgi-bin/setBinFileToServer.cgi

POST parameter:
Host: <server-ip>
Content-Type: application/x-www-form-urlencoded
Content-Length: <length>

Parameter:
 username=Administrator&password=<tan-md5-hash>&type=fileload_bin&
 module=<Target address of file>&data=<Data contents>

Return: -

3.2.5. Request directory contents

The client requests the contents of the directory declared under "module". The result is the directory contents in JSON format.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
 username=Administrator&password=<tan-md5-hash>&type=dir_download&module=<path of dir>

Return: <JSON structure>

```
{
  "files":
  [
    "counter.conf",
    "ewio2server.ini",
    "IoDriver.conf"
  ]
}
```

Example of JSON structure for the contents of a directory, here: Directory /var/opt/etc

3.2.6. Update firmware

The client sends a firmware file to the server, which uses it to update the device firmware. After this call, the communication is automatically ended by the server (in a similar way as if the function "Logout" was called). This is done even in the case where the firmware update process fails for some reason. To continue communication, a new session ID has to be requested.

Method: POST

URL: <server-ip>/cgi-bin/setBinFileToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:multipart/form-data; boundary=...

Content-Length:<length>

Parameter (each as a separate multipart form field, separated by the boundary string):

username=Administrator

password= <tan-md5-hash>

type=firmware_update

module= <Name of firmware file> (optional)

data= <Data contents> (with Content-Type: application/octet-stream)

Return: <Text>

The return text indicates the success of the firmware update process. In the case of success, "OK" is returned and the device is automatically rebooted to complete the firmware update procedure. Every other text indicates a failure of the firmware update process. In this case, the device is not rebooted and the firmware update can be retried (after requesting a new session ID). A failed firmware update process will not damage the firmware running on the device.

The following error messages can be returned:

Error message	Description
F_LEVEL	Insufficient access permissions. Only the user Administrator can update the device firmware.
FW_INVSIG	The signature of the firmware file is invalid. The firmware file was probably damaged.
FW_UNTAR	The extraction of the firmware file contents failed.
FW_DOWNGRADE	The firmware contained in the firmware file is older than the firmware running on the device.
FW_ERR	An unexpected error was experienced during the firmware update process.

3.3. Load / save device configuration

The device configuration is subdivided into multiple topics which are combined in a configuration data set. The configuration data set will either be in text format or in JSON format, depending on topic.

Configuration data sets on the following topics can be loaded and saved:

Topic	Module parameter	Data format	Load / save	Description
Gerät	device	JSON	load only	Device model and serial number
Version	version	JSON	load only	API version and software version
Date and time	datetime	JSON	Load and save	Configuration of date, time, time zone and timeserver
Device configuration	devicebase	JSON	load only	Device model, serial number, MAC address, software version and capacity of the flash drive
Memory	memory	JSON	load only	Capacity of flash drive and SD card
I/O connections	io_driver	Text	Load and save	Configuration of I/O connection of the EWIO ₂

3.3.1. Load device configuration

The client requests configuration data on a particular topic. The topic is declared as a parameter "module".

(Ex.: Topic date and time → module=datetime)

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=configuration&module=<Topic>

Return: <Configuration data set>

3.3.2. Save device configuration

The client sends configuration data to the EWIO₂ on a topic that should be stored there. The topic is declared as a parameter "module".

(Ex.: Topic date and time → module=datetime)

The configuration must be in the data format of the topic. With configuration data sets in JSON format, undeclared data remains unchanged. With configuration data sets in text format, the saved configuration is activated as a whole (undeclared data result in default values).

Method: POST

URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password= <tan-md5-hash>&type=configuration&
module= <Topic>&data= <Configuration data>

Return: -

```
{
  "model": "EWIO2-MW-BM",
  "serial": "00000018"
}
```

Example of JSON structure of the device configuration device

```
{
  "api-version": 1,
  "kernel-version": "4.9.88-ewio+g5ed2ee422",
  "package-version": "0.6",
  "build-number": "5f85065d"
}
```

Example of JSON structure of the device configuration version

```
{
  "datetime_utc": "2020-04-23 08:35:57",
  "datetime_local": "2020-04-23 10:35:57",
  "time_zone": "Europe/Berlin",
  "time_server_1": "0.de.pool.ntp.org",
  "time_server_2": "1.de.pool.ntp.org",
  "utc_timestamp": 0
}
```

Example of JSON structure of the device configuration `datetime`

Special aspects of saving the device configuration `datetime`:

- When `time_server_...` fields are declared, data on the current time is ignored.
- The field `datetime_utc` must be used to set the current time (the field `datetime_local` is ignored).
- After the device configuration `datetime` is saved, the API session should be ended with a reboot of the EWIO₂ (see section **Fehler! Verweisquelle konnte nicht gefunden werden.**) to set all system components to the new configuration.

```
{
  "model": "EWIO2-MW-BM",
  "devicename": "EWIO2-a58649",
  "mac_address": "70:b3:d5:a5:86:49",
  "serialnumber": "00000018",
  "package_version": "0.6",
  "build_number": "5f85065d",
  "v_kernel": "4.9.88-ewio+g5ed2ee422",
  "flash_size": 3625360,
  "flash_free": 3536248
}
```

Example of JSON structure of the device configuration `devicebase`

```
{
  "sdcard_available": true,
  "sdcard_format": "vfat",
  "flash_size": 3625360,
  "flash_free": 3536240,
  "sd_size": 3922944,
  "sd_free": 3922912
}
```

Example of JSON structure of the device configuration `memory`

```
; IO Driver Configuration, automatically generated
```

```
FileWriteCount = 2
```

```
[device]
```

```
VerHardware IO = 1
```

```
VerHardware REL = 3
```

```
[relay outputs]
```

```
RelHandEnable = 15
```

```
RelHandActive = 0
```

```
RelHandValue = 0
```

```
RelDefault = 0
```

```
[transistor outputs]
```

```
DoHandEnable = 15
```

```
DoHandActive = 0
```

```
DoHandValue = 0
```

```
DoDefault = 0
```

```
[digital inputs]
```

```
DiDebounce 0 = 8
```

```
DiDebounce 1 = 8
```

```
DiDebounce 2 = 8
```

```
DiDebounce 3 = 8
```

```
DiDebounce 4 = 8
```

```
DiDebounce 5 = 8
```

```
DiDebounce 6 = 8
```

```
DiDebounce 7 = 8
```

```
[analogue outputs]
```

```
AoHandEnable = 7
```

```
AoHandActive = 0
```

```
AoHandValue 0 = 0
```

```
AoHandValue 1 = 0
```

```
AoHandValue 2 = 0
```

```
AoHandValue 3 = 0
```

```
AoDefault 0 = 0
```

```
AoDefault 1 = 0
```

```
AoDefault 2 = 0
```

```
AoDefault 3 = 0
```

```
[analogue inputs]
```

```
AiRange 0 = 1
```

```
AiRange 1 = 1
```

```
AiRange 2 = 1
```

```
AiRange 3 = 0
```

```
AiSensor 0 = 0
```

```
AiSensor 1 = 0
```

```
AiSensor 2 = 0
```

```
AiSensor 3 = 0
```

```
[sensor characteristics]
```

```
SensorTable 0
```

Example of text structure of the device configuration `io_driver`

3.4. Functions for applications

3.4.1. Load application list

The client requests the list of the current applications on the EWIO₂. The parameter "module" is not used and can be empty or can just be omitted. The result is the list of the current applications in JSON format.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=applications&module=

Return: <JSON structure>

```
{
  "apps":
  [
    "example1",
    "example2"
  ]
}
```

Example of JSON structure of an application list

3.4.2. Load application

The client requests an application currently residing on the EWIO₂. The application is declared as a parameter "modul" without extension.

(Ex.: SOM_convert → module= SOM_convert)

The application has a special structure and is in JSON format.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=application&module=<Application>

Return: <JSON structure>

3.4.3. Save application

The client sends an application to the EWIO₂ that should be stored there. The file is declared as a parameter "modul" without extension.

(Ex.: SOM_convert → module= SOM_convert)

The application has a special structure and must be in JSON format.

Method: POST

URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password= <tan-md5-hash>&type=application&
module= <Application>&data= <JSON structure>

Return: -

```
{
  "name": "SOM_convert",
  "kill": 0,
  "run": 1,
  "script": "#!/bin/sh\n# Description: Convert S0/M response file from pulse
to counter values\n\n# Cycle (in us):\nCYCLE=1000000\n\n# Declaration:\n\n#
Initialization - runs one time:\n\n# execute program only with 2 arguments
\nif [ $# -ne 2 ]; then      \n exit      \nfi      \n\n# execute
conversion\n/config/bin/counter/counter_convertSOM $1 $2\n\n"
}
```

Example of JSON structure of an application (here: SOM_convert)

3.5. M-Bus functions

3.5.1. Load counter list

A list of the configured M-Bus counters is requested by the client.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_list&
module=mbus_add_auto

Return: <JSON structure>

```
{
  "counter":
  [
    {"ID":3,"BusAdr":"19235000-SYS-10-14","Name":"19235000-SYS-10-14"},
    {"ID":13,"BusAdr":"01040904-GAV-90-2","Name":"01040904-GAV-90-2"},
    {"ID":15,"BusAdr":"19235200-SYS-10-14","Name":"19235200-SYS-10-14"}
  ]
}
```

Example of JSON structure of a counter list

3.5.2. Delete counter configuration

The declared counter should be deleted from the configuration for M-Bus counters on the EWIO₂.

The counters to be deleted must be declared in a special JSON structure:

{"counter": [<Counter Bus addr_1>, <Counter Bus addr_2>, ...>]}

Method: POST

URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_remove&
module=mbus_remove&data=<JSON structure>

Return: -

```
data={
  "counter": [
    "19235200-SYS-10-14"
  ]
}
```


Example of JSON structure of a list for counters to be deleted

3.5.3. **Save counter configuration**

The configuration of an M-Bus counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter&
module=<Counter Bus addr>&data=<JSON structure>

Return: -

3.5.4. **Load counter configuration**

The configuration of the declared M-Bus counter is requested by the client.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter&
module=<Counter Bus addr>

Return: <JSON structure>

```
data={
  "ID":1,
  "BusAdr":"19235200-SYS-10-14",
  "PrimAdr":10,
  "VerwPrim":1,
  "Konfiguration":"",
  "LProfDP":"",
  "LSync":"",
  "BR":9600,
  "Name":"19235200-SYS-10-14",
  "Sort":1,
  "ZNummer":"123456",
  "Mandant":"",
  "AbnNr":"",
  "Gewerk":0,
  "Hersteller":"",
  "Konto":"",
  "Ort":"",
  "Kommentar":"",
  "btype":"MBus",
  "ztype":"",
  "meteringcode":{
    "Land": "DE",
    "Betreiber": 123456,
    "Plz": 12345,
    "MePuId": "EXAMPLE0123456789012"
  }
}
```

Example of JSON structure of a counter configuration

3.5.5. Load data point list

The list of data points of a M-Bus counter is requested. The list is represented in a special JSON format.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
 username=Administrator&password=<tan-md5-hash>&type=channels&
 module=<Counter Bus addr>

Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":1,
      "Zaehler_ID":1,
      "Freeze_ID":null,
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":5,
      "ZwTyp":"Volts",
      "MEinheit":"1.000000 V",
      "MessTyp":"normal",
      "Primaer":0,
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":"",
      "Tele":1,
      "Rec":1
    },
    {
      "ID":2,
      "Zaehler_ID":1,
      "Freeze_ID":null,
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":5,
      "ZwTyp":"Energy",
      "MEinheit":"10 Wh",
      "MessTyp":"normal",
      "Primaer":0,
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":"",
      "Tele":1,
      "Rec":2
    }
  ]
}
```

Example of JSON format of data point list

3.5.6. Save data point configuration

The configuration of a data point of a M-Bus counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=channel&
 module=<Counter Bus addr>&data=<JSON structure>

Return: -

3.5.7. Load data point configuration

The configuration of a data point of a M-Bus counter is requested. The configuration is represented in a special JSON format.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=channel&
 module=<Data point ID>

Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":1,
      "Zaehler_ID":1,
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":5,
      "ZwTyp":"Volts",
      "MEinheit":"1.000000 V",
      "MessTyp":"normal",
      "Primaer":0,
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":"",
      "Tele":1,
      "Rec":1
    }
  ]
}
```

Example of JSON format of data point configuration

3.5.8. Load M-Bus parameters for the documentation

The configuration of a counter with all associated data points is output as a text file.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=output&
module=mbus_<Counter Bus addr>

Return: <Text>

```
Counter ID: 1
Query Number: 1
Counter Name: 00243216-ABB-32-2
MBUS-ID: 00243216-ABB-32-2
Baudrate: 2400
Counter Number:
Client:
Customer:
Craft: 0
Manufacturer:
Account:
Location:
Counter Type:
Bus Type: MBus
Meteringcode: DE12345612345EXAMPLE0123456789012
```

```
Data Points
  Channel ID: 1
  Telegram Number: 1
  Record Number: 1
  Freeze ID:
  OBIS ID:
  Readout From: 2020-04-16 11:15:00
  Interval: 5
  Description: Cumulation Counter
  Factor Voltage: 1
  Factor Current: 1
  Factor: 1
  Unit: 1.000000 V
  Prim. Counter: 0
  Application:
  Application Arguments:
```

Example of JSON structure of counter configuration

3.5.9. M-Bus search

A search for M-Bus counters is done. During the search, progress report lines of the form "PROGRESS_..." will be returned. The completion of the search operation is indicated by a final line "FOUND_<number of counters found>". If the search operation is aborted for some reason (e.g., parallel start of another search operation), a final line "ABORTED" is returned. If the search operation cannot be done because of an error (e.g., invalid search parameters), a single line "ERROR" is returned.

Method: GET**URL:** <server-ip>/cgi-bin/getParamFromServer.cgi**Parameter:**

username=Administrator&password=<tan-md5-hash>&type=search& module=
mbus_<baud rate>[_search parameters]

Return: <Text>

The specification of search parameters is optional. If no search parameters are specified, a search over all secondary addresses will be done. The search parameters have the format <address type>[_address range], where address type can be either "sa" (for a search over secondary addresses) or "pa" (for a search over primary addresses). For address type "sa", an optional secondary address with wildcards can be specified as address range. For address type "pa", an optional primary address (as a single decimal number) or a primary address range (as two decimal numbers separated by a dash (<begin-end>)) can be specified as address range.

To search at another interface than the M-Bus interface, the address range can be prefixed with "rs485:" (search at RS-485 port) or "<IP-address>:<port>:" (search via TCP gateway).

```
PROGRESS_0FFFFFFFFFFFFFFF
PROGRESS_1FFFFFFFFFFFFFFF
PROGRESS_2FFFFFFFFFFFFFFF
PROGRESS_3FFFFFFFFFFFFFFF
PROGRESS_4FFFFFFFFFFFFFFF
PROGRESS_5FFFFFFFFFFFFFFF
PROGRESS_6FFFFFFFFFFFFFFF
PROGRESS_7FFFFFFFFFFFFFFF
PROGRESS_8FFFFFFFFFFFFFFF
PROGRESS_9FFFFFFFFFFFFFFF
FOUND_1
```

Example output for a search over all secondary addresses (parameter module=mbus_2400)

```
PROGRESS_10
PROGRESS_11
PROGRESS_12
PROGRESS_13
PROGRESS_14
PROGRESS_15
FOUND_3
```

Example output for a search over primary addresses 10 to 15 (parameter module=mbus_2400_pa_10-15)

3.5.10. M-Bus search results – Load counter list

A list of the M-Bus counters found in the last search is requested by the client.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_list&
module=mbus_search[_baud rate]

Return: <JSON structure>

The specification of a baud rate is optional. If a baud rate is specified, only counters found at the specified baud rate will be returned. If no baud rate is specified, the last search results at all baud rates will be returned.

```
{
  "counter":
  [
    { "BusAdr": "19235000-SYS-10-14", "PrimAdr": "10", "BR": 2400, "Name": "19235000-SYS-10-14" },
    { "BusAdr": "01040904-GAV-90-2", "PrimAdr": "11", "BR": 2400, "Name": "01040904-GAV-90-2" },
    { "BusAdr": "19235200-SYS-10-14", "PrimAdr": "12", "BR": 2400, "Name": "19235200-SYS-10-14" }
  ]
}
```

Example of JSON structure of a counter list after a search at 2400 baud

3.5.11. M-Bus search – Load data point list

The list of data points of a found M-Bus counter is requested. The list is represented in a special JSON format.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=channels&
module=mbus_search_<Counter Bus addr>

Return: <JSON structure>


```
{
  "channel": [
    {
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":0,
      "ZwTyp":"Volts",
      "MEinheit":"1.000000 V",
      "Primaer":0,
      "Faktor":1,
      "Tele":1,
      "Rec":1
    },
    {
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":0,
      "ZwTyp":"Energy",
      "MEinheit":"10 Wh",
      "Primaer":0,
      "Faktor":1,
      "Tele":1,
      "Rec":2
    }
  ]
}
```

Example of JSON format of data point list of a found counter

3.6. Modbus functions

3.6.1. Load counter type list

The templates of all configurable counter types are loaded. The counter types are contained in a special JSON structure.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
username=Administrator&password=<tan-md5-hash>&type=deviceType_list&module=modbus_config

Return: <JSON structure>

```
{
  "deviceTypes":
  [
    "modbus_schneider_Compact_NSX.json",
    "modbus_kbr_multimes_4F144-1-LED.json",
    "modbus_janitza_umg96s.json",
    "modbus_mc_mr-do4.json",
    "modbus_mc_mr-ai8_temperature.json",
    "modbus_mc_mr-ci4_current-0-20.json",
    "modbus_mc_mr-ai8_resistance.json",
    "modbus_schneider_PM3255.json",
    "modbus_schneider_iEM3250.json",
    "modbus_mc_mr-di10.json",
    "modbus_janitza_umg604.json",
    "modbus_janitza_umg503.json",
    "modbus_econ_sens+.json",
    "modbus_mc_mr-tp.json",
    "modbus_mc_mr-ci4_current-4-20.json",
    "modbus_mc_mr-ai8_voltage.json",
    "modbus_mc_mr-ci4_voltage.json",
    "modbus_mc_mr-si4.json",
    "modbus_mc_mr-di4.json",
    "modbus_schneider_iEM3255.json",
    "modbus_mc_mr-ao4.json"
  ]
}
```

Example of JSON format of counter type list

3.6.2. Load extended counter type list

The templates of all configurable counter types with template and counter type names are loaded. The counter types are contained in a special JSON structure.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
username=Administrator&password=<tan-md5-hash>&type=deviceType_object&module=modbus_config

Return: <JSON structure>

```
{
  "deviceTypes":
  [
    {"template":"modbus_schneider_Compact_NSX.json","type":"schneider_NX100"},
    {"template":"modbus_kbr_multimes_4F144-1-LED.json","type":"kbr_multimes-4F144-1-LED"},
    {"template":"modbus_janitza_umg96s.json","type":"janitza_umg96s"},
    {"template":"modbus_mc_mr-do4.json","type":"mc_mr-do4"},
    {"template":"modbus_mc_mr-ai8_temperature.json","type":"mc_mr-ai8_temperature (Configuration 0x80 - 0x89)"},
    {"template":"modbus_mc_mr-ci4_current-0-20.json","type":"mc_mr-ci4 (Configuration 0..20mA)"},
    {"template":"modbus_mc_mr-ai8_resistance.json","type":"mc_mr-ai8_resistance (Configuration 0x40)"},
    {"template":"modbus_schneider_PM3255.json","type":"schneider_PM3255"},
    {"template":"modbus_schneider_iEM3250.json","type":"schneider_iEM3250"},
    {"template":"modbus_mc_mr-di10.json","type":"mc_mr-di10"},
    {"template":"modbus_janitza_umg604.json","type":"janitza_umg604 (without discrete harmonic)"},
    {"template":"modbus_janitza_umg503.json","type":"janitza_umg503"},
    {"template":"modbus_econ_sens+.json","type":"econ_sens+"},
    {"template":"modbus_mc_mr-tp.json","type":"mc_mr-tp"},
    {"template":"modbus_mc_mr-ci4_current-4-20.json","type":"mc_mr-ci4 (Configuration 4..20mA)"},
    {"template":"modbus_mc_mr-ai8_voltage.json","type":"mc_mr-ai8 (Configuration 0x00, default)"},
    {"template":"modbus_mc_mr-ci4_voltage.json","type":"mc_mr-ci4 (Configuration 0..10V)"},
    {"template":"modbus_mc_mr-si4.json","type":"mc_mr-si4"},
    {"template":"modbus_mc_mr-di4.json","type":"mc_mr-di4"},
    {"template":"modbus_schneider_iEM3255.json","type":"schneider_iEM3255"},
    {"template":"modbus_mc_mr-ao4.json","type":"mc_mr-ao4"}
  ]
}
```

Example of JSON format of extended counter type list

3.6.3. Load counter list

A list of the configured Modbus counters is requested by the client.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_list&
module= modbus_output

Return: <JSON structure>

```
{
  "counter":
  [
    {"ID":14,"BusAdr":11,"Name":"mr do4"}
  ]
}
```

Example of JSON structure of a counter list

Note that the JSON structure field "BusAdr" can be represented numerically (in case of a plain Modbus/RTU-address), or as string (in case of a Modbus/TCP-address). Applications should be able to handle both representations.

3.6.4. Delete counter configuration

The declared counter should be deleted from the configuration for Modbus counters on the EWIO₂.

The counters to be deleted must be declared in a special JSON structure:

{ "counter": [<Counter Bus addr_1>, <Counter Bus addr_2>, ...>] }

Method: POST

URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_remove&
module=modbus_remove&data=<JSON structure>

Return: -

```
data={
  "counter": [
    "14"
  ]
}
```

Example of JSON structure of a list for counters to be deleted

3.6.5. Save counter configuration

The configuration of a Modbus counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=modbus_counter&module=<Counter Bus addr>&data=<JSON structure>

Return: -

3.6.6. Load counter configuration

The configuration of the declared Modbus counter is requested by the client.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=modbus_counter&module=<Counter Bus addr>

Return: <JSON structure>

```
{
  "ID":2,
  "BusAdr":6,
  "BR":0,
  "Name":"mr-ai8",
  "Sort":2,
  "ZNummer":"",
  "Mandant":"",
  "AbnNr":"",
  "Gewerk":0,
  "Hersteller":"",
  "Konto":"",
  "Ort":"",
  "Kommentar":"",
  "btype":"Modbus",
  "ztype":"mc_mr-ai8",
  "meteringcode": {
    "Land": "DE",
    "Plz": 12345,
    "Betreiber": 123456,
    "MePuId": "EXAMPLE0123456789012"
  }
}
```

Example of JSON structure of a counter configuration

Note that the JSON structure field "BusAdr" can be represented numerically (in case of a plain Modbus/RTU-address), or as string (in case of a Modbus/TCP-address). Applications should be able to handle both representations.

3.6.7. Load data point list

The list of data points of a Modbus counter is requested. The list is represented in a special JSON format.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi
Parameter:
username=Administrator&password=<tan-md5-hash>&type=modbus_channels&module=<Counter Bus addr>
Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":11,
      "Zaehler_ID":2,
      "Freeze_ID":null,
      "Rec":0,
      "Format":"INT16 HL",
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":1,
      "ZwTyp":"Volts",
      "MEinheit":"1.000000 V",
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":""
    },
    {
      "ID":12,
      "Zaehler_ID":2,
      "Freeze_ID":null,
      "Rec":1,
      "Format":"INT16 HL",
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 11:20:00",
      "Intervall":1,
      "ZwTyp":"Input Resistance 1-C2",
      "MEinheit":"",
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":""
    }
  ]
}
```

Example of JSON format of data point list

3.6.8. Save data point configuration

The configuration of a data point of a Modbus counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:
Host: <server-ip>

Content-Type: application/x-www-form-urlencoded
Content-Length: <length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=modbus_channel&
module=<Counter Bus addr>&data=<JSON structure>

Return: -

3.6.9. Load data point configuration

The configuration of a data point of a Modbus counter is requested. The configuration must be in a special JSON format.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=modbus_channel&
module=<Data point ID>

Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":12,
      "Zaehler_ID":2,
      "Obis_ID":"","
      "Rec":0,
      "Format":"INT16 HL",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2020-06-05 14:15:00",
      "Intervall":5,
      "ZwTyp":"Input Resistance 1-C2",
      "MEinheit":"","
      "App":"","
      "AppArgs":"","
      "Faktor":1,
      "Konfiguration":""
    }
  ]
}
```

Example of JSON format of data point configuration

3.6.10. Load Modbus parameters for the documentation

The configuration of a counter with all associated data points is output as a text file.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=output&
module=modbus_<Counter Bus addr>

Return: <Text>

```
Counter ID: 2
Query Number: 2
Counter Name: mr-ai8
Modbus Address: 6
Counter Number:
Client:
Customer:
Craft: 0
Manufacturer:
Account:
Location:
Counter Type: mc_mr-ao4
Comment:
Bus Type: Modbus
Meteringcode: DE12345612345EXAMPLE0123456789013
```

Data Points

```
Channel ID: 11
Freeze ID:
OBIS ID:
Record Number: 0
Readout From: 2020-04-16 11:15:00
Interval: 1
Description: Volts
Factor Voltage: 1
Factor Current: 1
Factor: 1
Unit: 1.000000 V
Application:
Application Arguments:
```

```
Channel ID: 12
Freeze ID:
OBIS ID:
Record Number: 0
Readout From: 2020-04-16 11:15:00
Interval: 1
Description: Input Resistance 1-C2
Factor Voltage: 1
Factor Current: 1
Factor: 1
Unit:
Application:
Application Arguments:
```

Example of JSON structure of counter configuration

3.7. System counter functions

3.7.1. Load counter list

A list of the configured system counters is requested by the client.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_list&
module= system_output

Return: <JSON structure>

```
{
  "counter":
  [
    { "ID":20, "Name":"DI1" }
  ]
}
```

Example of JSON structure of a counter list

3.7.2. Delete counter configuration

The declared counter should be deleted from the configuration for system counters on the EWIO₂.

The counters to be deleted must be declared in a special JSON structure:

{"counter": [<name_1>, <name_2>, ...>]}

Method: POST

URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=counter_remove&
module=system_remove&data=<JSON structure>

Return: -

```
data={
  "counter": [
    "DI1"
  ]
}
```

Example of JSON structure of a list for counters to be deleted

3.7.3. Save counter configuration

The configuration of a system counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi
POST parameter:
Host: <server-ip>
Content-Type: application/x-www-form-urlencoded
Content-Length: <length>
Parameter:
 username=Administrator&password= <tan-md5-hash> &type=system_counter&
 module= <Counter Name> &data= <JSON structure>
Return: -

3.7.4. Load counter configuration

The configuration of the declared system counter is requested by the client.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi
Parameter:
 username=Administrator&password= <tan-md5-hash> &type=system_counter&
 module= <Counter Name>
Return: <JSON structure>

```
{
  "ID":20,
  "BR":0,
  "Name":"DI1",
  "Sort":3,
  "ZNummer":"",
  "Mandant":"",
  "AbnNr":"",
  "Gewerk":0,
  "Hersteller":"",
  "Konto":"",
  "Ort":"",
  "Kommentar":"",
  "btype":"System",
  "meteringcode": {
    "Land": "DE",
    "Plz": 12345,
    "Betreiber": 123456,
    "MePuId": "EXAMPLE0123456789012"
  }
}
```

Example of JSON structure of a counter configuration

3.7.5. Load data point list

The list of data points of a system counter is requested. The list is represented in a special JSON format.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
 username=Administrator&password= <tan-md5-hash>&type=system_channels&module=<Counter Name>

Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":21,
      "Zaehler_ID":20,
      "Freeze_ID":null,
      "Signal":"di_00_0",
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2021-06-05 11:20:00",
      "Intervall":1,
      "ZwTyp":"Datenpunkt 1",
      "MEinheit":"",
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":""
    }
  ]
}
```

Example of JSON format of data point list

3.7.6. Save data point configuration

The configuration of a data point of a system counter is saved. The configuration must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:
 Host:<server-ip>

Content-Type:application/x-www-form-urlencoded
 Content-Length:<length>

Parameter:
 username=Administrator&password= <tan-md5-hash>&type=system_channel&
 module=<Counter Name>&data=<JSON structure>

Return: -

3.7.7. Load data point configuration

The configuration of a data point of a system counter is requested. The configuration must be in a special JSON format.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=system_channel&
module=<Data point ID>

Return: <JSON structure>

```
{
  "channel": [
    {
      "ID":21,
      "Zaehler_ID":20,
      "Signal":"di_00_0",
      "Obis_ID":"",
      "Faktor_U":1,
      "Faktor_I":1,
      "EAblesung":"2021-06-05 14:15:00",
      "Intervall":1,
      "ZwTyp":"Datenpunkt 1",
      "MEinheit":"",
      "App":"",
      "AppArgs":"",
      "Faktor":1,
      "Konfiguration":""
    }
  ]
}
```

Example of JSON format of data point configuration

3.7.8. Load system counter parameters for the documentation

The configuration of a counter with all associated data points is output as a text file.

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=output&
module=system_<Counter Name>

Return: <Text>

```
Counter ID: 20
Query Number: 1
Counter Name: DI1
Modbus Address: 6
Counter Number:
Client:
Customer:
Craft: 0
Manufacturer:
Account:
Location:
Comment:
Bus Type: System
Meteringcode: DE12345612345EXAMPLE0123456789013

Data Points
  Channel ID: 21
  Freeze ID:
  OBIS ID:
  Signal: di_00_0
  Readout From: 2021-04-16 11:15:00
  Interval: 1
  Description: Datenpunkt 1
  Factor Voltage: 1
  Factor Current: 1
  Factor: 1
  Unit:
  Application:
  Application Arguments:
```

Example of JSON structure of counter configuration

3.8. Common counter functions

3.8.1. Live-Check

The check of the communication link to a configured counter is requested.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:
 username=Administrator&password=<tan-md5-hash>&type=testalive&
 module=<Counter-ID>

Return: <Text>

The Counter-ID is the ID value of the counter whose communication link is to be checked. The response text is **ACK** if the communication link to the counter operates without errors, **NACK** if there is a problem with the communication link (counter does not respond) or **ERROR** if the communication link cannot be checked (counter query service not available).

3.9. SQL functions, general

3.9.1. *Send a SQL instruction*

A SQL instruction with any content is sent from the client to the server.
The type of response is identified by the parameter "type":

db_str = response immediately as text string

db_json = response immediately in JSON format

db_str_<number> = response in following function call as text string

db_json_<number> = response in following functional call in JSON format

<number> = any random number under which the result of the instruction is available

The parameter "module" is not used and can be empty or can just be omitted.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host:<server-ip>

Content-Type:application/x-www-form-urlencoded

Content-Length:<length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=db_str_1234&
module=&data=<SQL statement>

Return: <Data> (only if response immediate)

3.9.2. *Obtain the result of a SQL instruction*

The result of a SQL instruction sent with response in the following function call is available in a temporary file. After the data is retrieved, the file is automatically deleted.

If the data is not yet available at the time of retrieval, "WEBGATE ERROR – NO FILE" is returned. The call must then be repeated after a specific period of time.

Method: GET
URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=db_str_1234&module=

Return: <Data>

3.10. SQL functions, special

3.10.1. Load measured values from the data base

Measured values of a particular data point of a declared time range is requested. If there is no quantity or an invalid quantity of measurement data specified, 24 measurement values will be retrieved as default (if available).

The data point – underscore – time range – underscore – quantity is declared as a module. The data point is declared with its data point ID.

Time range: -1 = last dates

 0 = first dates

 1 = dates beginning at (1 | <date time>)

Quantity is the number of retrieved measurement values (default 24). Consider that a big / very big number of measurement values may take long processing time or may be not processed at all!

Method: GET

URL: <server-ip>/cgi-bin/getParamFromServer.cgi

Parameter:

username=Administrator&password=<tan-md5-hash>&type=db_data&
module=<Data point ID_Time range_Quantity>

Return: <JSON structure>

```
{
  "data":
  { "channelData":
    [
      { "Kanal_ID":2, "Zeit":"2020-05-08
11:15:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" },
      { "Kanal_ID":2, "Zeit":"2020-05-08
11:20:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" },
      { "Kanal_ID":2, "Zeit":"2020-05-08
11:25:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" },
      { "Kanal_ID":2, "Zeit":"2020-05-08
11:30:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" },

      ....

      { "Kanal_ID":2, "Zeit":"2020-05-08
13:05:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" },
      { "Kanal_ID":2, "Zeit":"2020-05-08
13:10:00", "Werte":0.000000, "Flags":"S;A;P;G;N;I;T", "Grund":"" }
    ]
  }
}
```

Example of JSON format of requested measured values

3.10.2. *Save measured values to the data base*

One or more measured values are saved in the data base on the EWIO₂. These values must be in a special JSON format.

Method: POST
URL: <server-ip>/cgi-bin/setParamToServer.cgi

POST parameter:

Host: <server-ip>

Content-Type: application/x-www-form-urlencoded

Content-Length: <length>

Parameter:

username=Administrator&password=<tan-md5-hash>&type=db_send&
module=mbus&data=<JSON structure>

Return: -

```
{
  "channelData":
  [
    {
      "Kanal_ID":93,
      "Zeit":"2020-06-05 13:45:59",
      "Werte":1682,
      "Flags":"S;A;P;G;N;I;T",
      "Grund":""}
  ]
}
```

Example of JSON format of measured values to be saved

4. Data base structure

The data base structure of the EWIO₂ is generated with the following SQL statements (correspondences represent equivalent data base fields of the predecessor device EWIO-M):

```
CREATE TABLE `Counter` ( -- Basic properties of counter devices
  -- Unique ID of counter, corresponds to t_zaepler.ID
  `znr`          INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Secondary address of M-bus counter, unused for other devices, corresponds to t_zaepler.BusAdr
  `address`      TEXT,
  -- Primary address of M-bus counter or Modbus address of Modbus counter, corresponds to
  t_zaepler.BusAdr
  `prim`        INTEGER,
  -- Name of counter (assigned by user), corresponds to t_zaepler.Name
  `name`         TEXT,
  -- Bus type of counter (can be MBUS, MODBUS or SYSTEM), corresponds to t_zaepler.BTyp_ID and
  t_btype.Kinds
  `bus`         TEXT,
  -- Type of counter (selected by user, links to ID of row of MBusCounterTypes table for M-bus
  counter, name of Modbus-template for Modbus counter), corresponds to t_zaepler.ZTyp_ID and
  t_ztype.Kinds
  `devicetype`   TEXT,
  -- Baud rate of M-bus counter, unused for other devices, corresponds to t_zaepler.BR, default I/O
  line for system counters
  `baud`        INTEGER,
  -- Rank of counter for measurement value retrieval, measurement values from counter with lowest
  rank are retrieved first, corresponds to t_zaepler.Sort
  `rank`        INTEGER,
  -- Use secondary addressing instead of primary addressing for M-bus counter, unused for other
  devices
  `use_sec`      INTEGER,
  -- Additional counter configuration data, number of load profile records to read out for EMH-DIZ
  counters, unused for other devices
  `config`      TEXT,
  -- Index of first load profile data point for EMH-DIZ counters, unused for other devices
  `first_lp_dp`  INTEGER,
  -- Time of last real-time clock synchronization for EMH-DIZ counters, unused for other devices
  `last_sync`    TEXT
);

CREATE TABLE `Counter_extension` ( -- Extended informational properties of counter
  devices
  -- Unique ID of counter, links to related row of Counter table
  `znr`          INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Craft property of counter (assigned by user)
  `craft`        INTEGER,
  -- Counter number property of counter (assigned by user), corresponds to t_zaepler.ZNummer
  `counternumber` TEXT,
  -- Manufacturer property of counter (assigned by user)
  `manufacturer` TEXT,
  -- Location property of counter (assigned by user)
  `location`     TEXT,
  -- Account property of counter (assigned by user)
  `account`      TEXT,
  -- Client property of counter (assigned by user), corresponds to t_zaepler.Mandant
```

```

`client` TEXT,
-- Customer property of counter (assigned by user), corresponds to t_zaebler.AbnNr
`customer` TEXT,
-- Metering-code country property of counter (assigned by user), corresponds to
  t_meteringcode.Land
`mc_country` TEXT,
-- Metering-code operator property of counter (assigned by user), corresponds to
  t_meteringcode.Betreiber
`mc_operator` TEXT,
-- Metering-code postcode property of counter (assigned by user), corresponds to
  t_meteringcode.Plz
`mc_postcode` TEXT,
-- Metering-code counter number property of counter (assigned by user), corresponds to
  t_meteringcode.MePuId
`mc_counternumber` TEXT,
-- Comment property of counter (assigned by user)
`comment` TEXT
);

CREATE TABLE `Datapoints` ( -- Basic properties of data points
  -- Unique ID of data point, corresponds to t_kanal.ID
  `id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Unique ID of counter containing data point, links to related row of Counter table, corresponds
    to t_kanal.Zaebler_ID
  `znr` INTEGER,
  -- Index of data point within its counter for M-Bus and System counters, enumerates data points
    of a counter starting at 1, value is fixed to -1 for Modbus counter data points
  `dpnr` INTEGER,
  -- Index of corresponding freeze data point within its counter, or 0 if data point does not have
    a freeze data point
  `freeze_id` INTEGER,
  -- Modbus register address of Modbus counter data point, I/O line for system counter data point,
    index of M-Bus response telegram the datapoint is located in for M-Bus counter data points,
    corresponds to t_kanal.Rec for Modbus data points and to t_kanal.Tele for M-Bus data points
  `register` INTEGER,
  -- Name of data point, corresponds to t_kanal.ZwTyp
  `name` TEXT,
  -- Factor value of data point, applied before database insertion of measurement values,
    corresponds to t_kanal.Faktor_edit
  `factor` REAL,
  -- Unit of data point, corresponds to t_kanal.Einheit_edit
  `unit` TEXT,
  -- Measurement value query frequency of data point, corresponds to t_kanal.Intervall
  `range` INTEGER,
  -- Time of last data point readout or configuration change
  `last` INTEGER,
  -- Unique ID of data point with range minimization for BACnet server
  `bacnet_id` INTEGER
);

CREATE TABLE `Datapoints_extension` ( -- Extended properties of data points
  -- Unique ID of data point, links to related row of Datapoints table
  `id` INTEGER PRIMARY KEY UNIQUE,
  -- Time of first data point readout, corresponds to t_kanal.EAblesung
  `readout` TEXT,
  -- Type of measurement processing for data point (0: normal, 1: average, 2: minimum, 3: maximum),
    corresponds to t_kanal.MessTyp
  `measuring` INTEGER,
  -- Primarity property of data point, corresponds to t_kanal.Primaer

```

```

`prim`      INTEGER,
-- Voltage factor of data point, applied before database insertion of measurements for data point
  related to a voltage, corresponds to t_kanal.Faktor_U
`u`      REAL,
-- Current factor of data point, applied before database insertion of measurements for data point
  related to a current, corresponds to t_kanal.Faktor_I
`i`      REAL,
-- Data type of Modbus data point, unused for data points not belonging to a Modbus counter
`datatype`      TEXT,
-- Temperature sensor type of data point, links to ID of row of TempSensorTypes table,
  corresponds to t_temp.SensTyp
`sens_type`      INTEGER,
-- Offset to be applied after temperature sensor data transformation of measurement value,
  corresponds to t_temp.Offset
`sens_offset`      REAL,
-- OBIS-ID of data point (assigned by user), corresponds to t_kanal.Obis_ID
`obis_id`      TEXT,
-- Application script to be executed during measurement value retrieval, corresponds to
  t_kanal.App
`app`      TEXT,
-- Arguments to be supplied to application script executed during measurement value retrieval
`app_args`      TEXT,
-- Additional datapoint configuration data, a value > 0 indicates that a new measurement should
  be saved only if it differs from the last saved measurement
`config`      TEXT
);

CREATE TABLE `MBusCounterTypes` ( -- Types of M-bus counters
  -- Unique ID of M-bus counter type
  `id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Name of M-bus counter type
  `name` TEXT
);

CREATE TABLE `TempSensorTypes` ( -- Types of temperature sensors
  -- Unique ID of temperature sensor, corresponds to t_sensor.ID
  `id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Name of temperature sensor type (shown to user in type selection list), corresponds to
    t_sensor.Name
  `name` TEXT
);

CREATE TABLE `ModbusCounterModels` ( -- Types (models) of Modbus counters
  -- Unique ID of Modbus counter type
  `model_id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Default Modbus address of Modbus counter type
  `address` INTEGER,
  -- Name of Modbus counter type
  `modelname` TEXT UNIQUE,
  -- Template of Modbus counter data points
  `template` TEXT);

CREATE TABLE `ModbusCounterModelsDatapoints` ( -- Default data points of Modbus
  counter types devices
  -- Unique ID of default Modbus counter data point
  `db_id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
  -- Unique ID of Modbus counter type, links to related row of ModbusCounterModels table
  `model_id` INTEGER,
  -- Index of default datapoint within a Modbus counter type, enumerates data points of a counter
    type starting at 1

```

```

    `dpnr`      INTEGER,
-- Modbus register address of default data point
    `register`   INTEGER,
-- Name of default data point
    `name`      TEXT,
-- Unit of default data point
    `unit`      TEXT,
-- Data type of default data point
    `format`    TEXT,
-- Default factor for data point
    `factor`    TEXT,
-- Default obis_id for data point
    `obis_id`   TEXT
);

CREATE TABLE `Measurements` ( -- Measurement values
-- Unique ID of measurement value, corresponds to t_daten.ID
    `id` INTEGER PRIMARY KEY AUTOINCREMENT UNIQUE,
-- Unique ID of data point that provided the measurement value, links to related row of
    Datapoints table, corresponds to t_daten.Kanal_ID
    `dpid`      INTEGER,
-- Sample time of measurement value, corresponds to t_daten.Zeit
    `sampletime` TEXT DEFAULT CURRENT_TIMESTAMP,
-- Value (result of all transformations applied during the readout process) of measurement value,
    corresponds to t_daten.Werte
    `value`     REAL DEFAULT 0,
-- Flags of measurement value, corresponds to t_flags.Flags
    `flags`     TEXT,
-- Additional description of measurement value
    `reason`    TEXT
);

```