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CloudGate

CloudGate User Guide

CloudGate 3G Americas (CG0192)

Table Of Content

CloudGate 3G Americas

Model: CG0192

The CloudGate 3G Americas is a 3G multiband M2M gateway providing internet connectivity at HSPA+ and EV-DO data rates.

The base unit is designed around a main board and a WWAN module. It's main features are listed in the table below:

Feature	Description
WWAN 3G/2G	• UMTS/HSDPA/HSUPA/HSPA+: 850/900/1900/2100 MHz and AWS band (1700/2100 MHz) (B 1, 2, 4, 5, 8) • CDMA 1xRTT/EV-DO rev0/EV-DO revA: 800/1900 (BC0, BC1) • GSM/GPRS/EDGE: 850/900/1800/1900 MHz • Maximum connectivity speed: HSPA+: 14.4 Mbps (Cat 10) down and 5.76 Mbps (Cat 6) up • Maximum connectivity speed: EV-DO RevA mode: 3.1 Mbps FL/1.8 Mbps RL • RX diversity: Simultaneous Equalization and Rx Diversity on all bands, except for GSM/GPRS/EDGE
GPS	• Standalone GPS, Assisted GPS, GPS OneXTRA • Wideband GPS processing (20MHz) for improved measurement accuracy
Antenna connectors	• 1 x SMA: WWAN Main • 1 x SMA: WWAN Div/GPS
Ethernet (IEEE 802.3)	• 10/100Mb/s RJ45 Connector
Visual indicators	• Seven 3 color LEDs showing system status and signal strength
SIM	• USIM/SIM class B and class C

Feature	Description
Power input	• DC input voltage: 9-33 V DC • Connector type: Micro-Fit 3.0™, Dual row, 4 circuits
Expansion Card Slots	• Two expansion card slots (one at the front and one at the back side of the device) • Expansion boards for I/O functions, such as Serial, USB, GPIO, WLAN, Accelerometer, etc.
Metal case	• Aluminum housing • Dimensions: 115 x 105 x 45 mm (excluding antenna connectors) • Weight: 294 g • Mounting: bulkhead - 6 x M4 mounting holes or DIN rail with adapter
Environmentals	• Operating temperature: -30°C to 70°C (*) • Storage temperature: -40°C to 85°C • Humidity operational: 5% - 95% non condensing
Certification	• FCC, IC, PTCRB, IFETEL
Standard compliance	• ROHS, Reach
CloudGate Universe	• Device can be configured OTA using CloudGate Universe

(*) See Safety Warning in the Environmental Specifications section

A more detailed hardware description can be found in the corresponding subsections.

A datasheet of the CloudGate 3G Americas can be found here.

The CloudGate 3G Americas has two expansion card slots that allow to insert a variety of expansion cards.

Main Board

The CloudGate 3G Americas is designed around a main board and a 3G WWAN module. The processor on the main board controls all the interfaces. The WWAN module provides the wireless connectivity to the internet.

The CloudGate also has two expansion board connectors to allow insertion of dedicated expansion cards.

The block diagram shows the overview.

Main Board Block Diagram (PDF)

Power Input

- V_PWR: min 9V DC, max 33V DC

Internal Power Supply

- Power input: V_PWR, min 9V DC, max 33V DC
- Stable 3.4V power rail
- Reverse polarity protection
- Over-voltage protection up to 60V
- Current limiter at 1.2A
- One-time fuse of 2A

Main Board Processor

- Freescale i.MX280 @ 450MHz
    - 64 MB RAM
    - 128 MB Flash memory
    - Ethernet interface
    - interfaces to the two expansion board connectors

Primary Expansion Card Slot

The primary expansion card slot is located at the front side of the CloudGate.

It has the following interfaces:

- Power supply: V_PWR, 3V4, 3V3
- 24 Mhz clock signal
- Master reset signal
- High speed USB interface
- High speed OTG USB interface

- SDIO interface
- GPIO signals
- Serial interface

Secondary Expansion Card Slot

The secondary expansion card slot is located at the back side of the CloudGate.

It has the following interfaces:

- Power supply: V_PWR, 3V4, 3V3
- 24 Mhz clock signal
- Master reset signal
- High speed USB interface
- SDIO interface
- GPIO signals

WWAN module

The WWAN module in the CloudGate 3G Americas is a 3G Gobi module. The module type number is GTM689.

Front and Back View

The CloudGate Base Unit is assembled in the top half of the device. The bottom half is available for the insertion of expansion cards.

The front and back side of the CloudGate housing are closed by means of metal panels that are secured with Torx T6 screws.

The top panels are designed by Option and cannot be changed, since they provide the interfaces of the base unit. The bottom panels can be customized to match the external interfaces of the expansion card.

Front View

Connectors and LED indicators on the top front panel

On the front side of the device we can see the following connectors:

1	WWAN Diversity and GPS antenna connector	SMA-female
2	Ethernet port	10/100 Mbps RJ-45
3	WWAN Main antenna connector	SMA-female
4	Torx T6 screws	-

A detailed description of the LEDs is given in the section about the LED Indicators.

Bottom Front Panel

The bottom front panel covers the front expansion slot and has to be removed when installing a Primary Expansion Card.

Option provides a custom panel for the following primary expansion cards:

- Low Cost Serial Card
- Industrial Serial Card
- Ethernet Switch
- Ethernet Switch with PoE
- Telematics Card
- Breadboard Card

Back View

Connector and button on the top back panel

1	Power connector	• 9-33 VDC • Micro-Fit 3.0, dual row, 4 circuits
2	Reset button	• The explanation on how to use the reset button is explained here

The functionality of the button is explained in the section about the Reset button

Behind the top back panel there is a socket for insertion of a SIM card.
Please also refer to the section about the SIM Card Interface for more details.

Bottom Back Panel

The bottom back panel covers the back expansion slot and has to be removed when installing a Secondary Expansion Card.

Option provides a custom panel for the following secondary expansion cards:

- WLAN Expansion Card
- WLAN Access Point Card

LED Indicators

LED	Description
WLAN State	Indicates the connection status of the WLAN interface Off: not installed Orange: WLAN board = OK, client not connected and AP not enabled Orange blinking: AP disabled and Client connected / data traffic Red: board error/ (Any that causes AP or Client not to work) Green: AP enabled Green flashing: AP enabled and Client connected/data traffic
WLAN Client Signal Strength	Indicates the signal strength of the WLAN CLIENT interface when connected to a WLAN access point Off: The WLAN CLIENT is off or not connected Orange: The WLAN Client is receiving a moderate signal strength Red: The WLAN Client is receiving bad signal strength Green: The WLAN client is receiving good signal strength Green flashing: n/a
GPS/Aux State	Indicates the GPS operation Off: off Orange: on, no fix Red: error

LED	Description
	Green: on, has fix Green flashing: n/a
GPS/Aux signal strength	Indicates the signal strength of the GPS Off: no signal Orange: moderate GPS signal Red: bad GPS signal Green: good GPS signal Green flashing: n/a
System State	Indicates successful power on and device readiness Off: no power Orange: booting Red: error Green: on Green flashing: n/a
WWAN State	Indicates WWAN or 3G interface availability and use Off: no power or not connected Orange: on, not connected Red: WWAN error Green: on, connected Green flashing: data traffic
WWAN Signal Strength	Indicates WWAN or 3G interface signal strength Off: no power or not connected Red: bad signal strength (< -104dbm) Orange: moderate signal strength (>= -104dbm & < -94dbm) Green: good signal strength (>= -94dbm)

Special LED functions:

When the CloudGate is downloading new firmware from the CloudGate Universe the LED behaviour is different compared to normal behaviour. In this situation the LEDs are moving fast from left to right and back. The colors of the LEDs indicate the next:

- Orange: A new firmware is being downloaded
- Green: The download was successful. (This will be followed by a reset of the CloudGate)

- Red: The download was not successful.

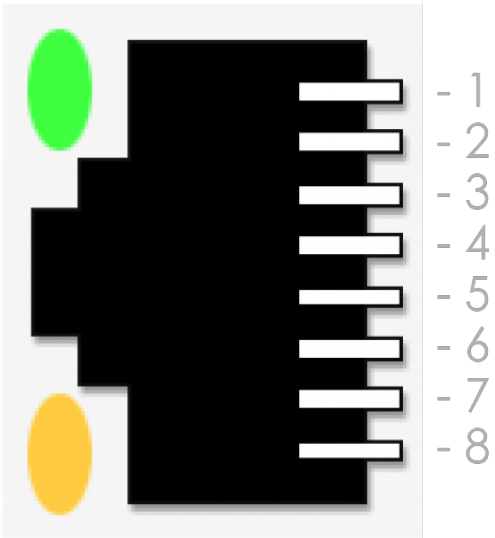
1.4. Ethernet Interface

This section describes the Ethernet interface on the CloudGate main board.

Ethernet Interface

- RJ-45 receptacle tab on top
- 10/100 Mbps
- 100BASE-TX
- Auto-MDIX

Pinout



Yellow LED:

- Active when operating speed is 100 Mbps
- Inactive when operating speed is 10 Mbps or when not connected

Green LED:

- Active when valid links are detected
- Blinks when activity is detected
- Inactive when not connected

Pin #	Function
1	TX/RX+
2	TX/RX-
3	RX/TX+
4	Not used

Pin #	Function
5	Not used
6	RX/TX-
7	Not used
8	Not used

IMPORTANT: The auto-MDIX feature is always activated on the CloudGate. This feature automatically detects the required cable connection type (straight or crossed), and configures the connection appropriately, removing the need for crossover cables.
In order for auto-MDIX to work correctly, auto-negotiation (auto speed and auto duplex) must be enabled on both sides of the link. Note that auto negotiation is always active on the CloudGate.

WAN/LAN Switchover Feature

The WAN/LAN switchover feature is a mechanism to maximize the internet connectivity via the Ethernet port.

The description of the related configuration parameters and the switchover mechanism itself can be found in the Ethernet Tab section of the CloudGate Setup Guide.

RF specifications of the CloudGate 3G Americas

WWAN Interface

Supported Frequencies

- GSM, GPRS, and Edge bands: 850/900/1800/1900
- WCDMA bands: I, II, IV, V, VIII
- CDMA bands: BC0,1

Output Power

- Power Class 4 (2W, 33dBm) for GSM, GPRS 850/900 MHz bands
- Power Class 1 (1W, 30dBm) for GSM, GPRS 1800/1900 MHz bands
- Power Class E2 (0.5W, 27dBm) for Edge 850/900MHz bands
- Power Class E2 (0.4W, 26dBm) for Edge 1800/1900 MHz bands
- Power Class 3 (0.25W, 24dBm) for UMTS 850/900/1900/2100 MHz bands

Antenna Interfaces

Main WWAN Antenna

The main antenna is labelled WWAN Main on the front panel. Learn about antenna recommendations for the CloudGate 3G Americas.

Connectors

- The RF connector on the CloudGate is SMA female.

- The antenna itself or the connector to the antenna should be SMA male.

Frequency Range

- Allows all frequency bands which the integrator wants to use

Performance

- Radiation pattern: Omni-directional
- Efficiency over all used frequencies: > 50%
- Maximum VSWR: < 2.5:1 with 50 ohm reference impedance

Polarization

- Linear

RF EXPOSURE WARNING
To comply with regulatory requirements, please check the maximum allowed antenna gain for your your external antenna! The maximum gain is specified for each product in the certification information section of the CloudGate 3G Americas.

Diversity WWAN Antenna

The diversity antenna is labelled WWAN Div GPS on the front panel. Learn about antenna recommendations for the CloudGate 3G Americas.

IMPORTANT: The diversity antenna is by default disabled (from firmware version 1.9.0 onwards). Learn how to enable the diversity antenna.

Connectors

- Uses the same type of connector as the main WWAN antenna

Frequency range

- Receive diversity only works on WCDMA and CDMA bands
- Only WCDMA and CDMA bands have to be supported by the diversity antenna.
- The GPS frequency must also be supported if GPS functionality is desired on the CloudGate.

Efficiency

- Radiation pattern: Omni-directional
- Efficiency over all used frequencies: > 25%
- Maximum VSWR: < 2.5:1 with 50 ? reference impedance

Polarization

- Linear

Mutual coupling (main antenna and diversity antenna)

- Isolation: > 8dB
- Envelope correlation coefficient: < 0.5

GPS Antenna

There are two hardware variants of CloudGate 3G Americas: one with passive GPS and one with active GPS.

- This section explains the variant with passive GPS antenna, it has no power supply for active antennas on the RF connector. For accurate GPS operation make sure the GPS antenna has a clear view of the sky.
- The variant with active GPS is explained in the section about Active GPS

Maximum VSWR

- < 2.5:1 with 50ohms reference impedance

Polarization

- RHCP antenna or a vertical polarized antenna

Frequency range

- Frequency range for GPS: 1575.42MHz ± 1MHz

Efficiency

- Efficiency: > 50%.

Important: a CloudGate 3G Americas with active GPS does not support 3G diversity. Instead it must be equipped with an active GPS antenna. See the relevant section about Active GPS for more information.

RF EXPOSURE WARNING

To comply with regulatory requirements, please check the maximum allowed antenna gain for your your external antenna! The maximum gain is specified for each product in the certification information section of the CloudGate 3G Americas.

Antenna recommendations for the CloudGate 3G Americas

A number of good antennas are available on the market for use with the CloudGate. Below is a list of antennas which can be used as a reference for each functionality.

All antennas listed below are made by Taoglas and are available via DigiKey

Main WWAN Antenna

Taoglas TG.09.0113

- Recommended as the standard Main and Diversity antennas
- Recommended for all bands except GPS

Diversity and GPS Antenna

There are two recommended options for the Diversity and GPS Antenna.

Option A

Taoglas TG.30.8113

- Recommended for all bands including GPS

- Can be used as main antenna but very large

Option B

Grand-Tek OA-LTE-01-01-GTT

Important: a CloudGate 3G Americas with active GPS does not support 3G diversity. Instead it must be equipped with an active GPS antenna. See the relevant section about Active GPS for more information.

Related Topics

RF Specification of the CloudGate 3G Americas

3G Connection Tab

CloudGate 3G Americas with active GPS

Customers who need active GPS have to order a dedicated variant of the CloudGate. This variant supplies 3.4V to the SMA connector in order to power the LNA in the active GPS antenna.

Requirements for the active GPS antenna

- Support GPS and Glonass
- Noise Figure < 2dB
- Preferably built-in pre-filter: this gives some freedom in positioning the two antennas (main antenna and GPS). No pre-filter means the antennas should be separated > 1m
- 15-30dB gain @ 3.4V

Example Toaglass AA.161.301111

Top view Bottom view

This antenna has a 3m extension cable for optimal positioning, e.g. on a dashboard of a car.

A datasheet of the Taoglass antenna AA.161.301111 can be found here.

Warning: a standard CloudGate 3G Americas can not be upgraded in the field. The support for active GPS is implemented in the factory. There is a dedicated order number for a CloudGate 3G Americas with active GPS

Warning: a CloudGate 3G Americas with active GPS does not support a 3G diversity antenna

Power Requirements

Base Unit Power Supply

The symbol on the label at the bottom side of the CloudGate shows the power requirements:

- Input voltage must be between 9V - 33V DC
- Internal electronic fuse limits the input current to 1.2A

For the power cable between the external power supply unit and the CloudGate Option recommends to use a power cable that has a wire thickness of 22 AWG!

SAFETY WARNING
This CloudGate operates on DC power provided by a DC power supply or by an AC power adapter. Only use power supplies in the range 9-33V DC and make sure the product is installed near a power outlet that is easily accessible.

SAFETY WARNING
When using an AC adapter make sure that the ambient temperature doesn't exceed the specified temperature limits of the AC adapter.

SAFETY WARNING
The CloudGate is regarded a Class III equipment: this means that the protection against electrical shock is provided by means of power supplied by an SELV (Safety Extra Low Voltage) circuit and that the CloudGate does not generate hazardous voltages within itself.

As a reference, the power supply available from Option has the following parameters:

- Output voltage 12V DC
- Max output current 1A

In case you would like to use an industrial power supply Option recommends the next:

http://www.us.tdk-lambda.com/ftp/Specs/dspa.pdf

It can be sourced through Farnel, Mouser, Digikey, ...

Power Connector

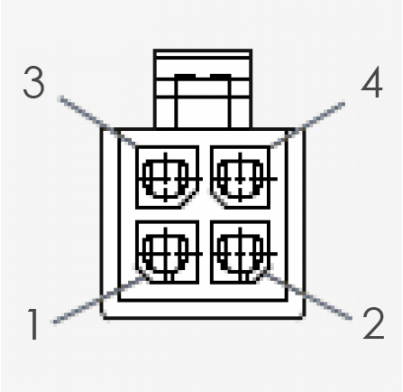
The power connector is a Micro-Fit connector from Molex (MX-43025-0400)

Power Connector Drawing (PDF)

Power Connector Datasheet (PDF)

Pinout

The following drawing shows the pinout of the power connector, seen from the terminal side.



Pin #	Function
1	Input voltage
2	GND
3	Not connected
4	Not connected

Power Consumption

You can find here a document describing all the different power consumption numbers

Preventing Fuse Overload

SAFETY WARNING
On old CloudGate models, a huge inrush current caused by capacitors inside the CloudGate may cause an internal fuse to break. When using an external power supply with an output voltage higher than 15V, Option recommends using a special cable which will reduce the amplitude of these charge currents. This cable can be obtained

at your CloudGate distributor.
If the fifth digit of the serial number of the CloudGate is a "C", the CloudGate is an older model and susceptible to this remark. If the fifth digit is not a "C", the fuse of your CloudGate will not get broken due to these charge currents.

Internal Power Circuits

The voltage applied by the power adapter to the CloudGate is converted into different voltage rails on the main board. Two different power circuits make five different voltage rails.

Dedicated high current power circuit

- Provides two different voltage rails which both can deliver high current levels:
    - V_PWR: At the power adapter input of the CloudGate there is an overvoltage protection circuit and a current limiter of 1.2A. The V_PWR is the voltage level behind the current limiter. The protection circuit causes a little voltage drop lower than 1V.
    - 3V4: the 3V4 is a power rail generated by a dedicated power circuit on the main board. The 3V4 is used on the main board and is also available on the expansion boards.

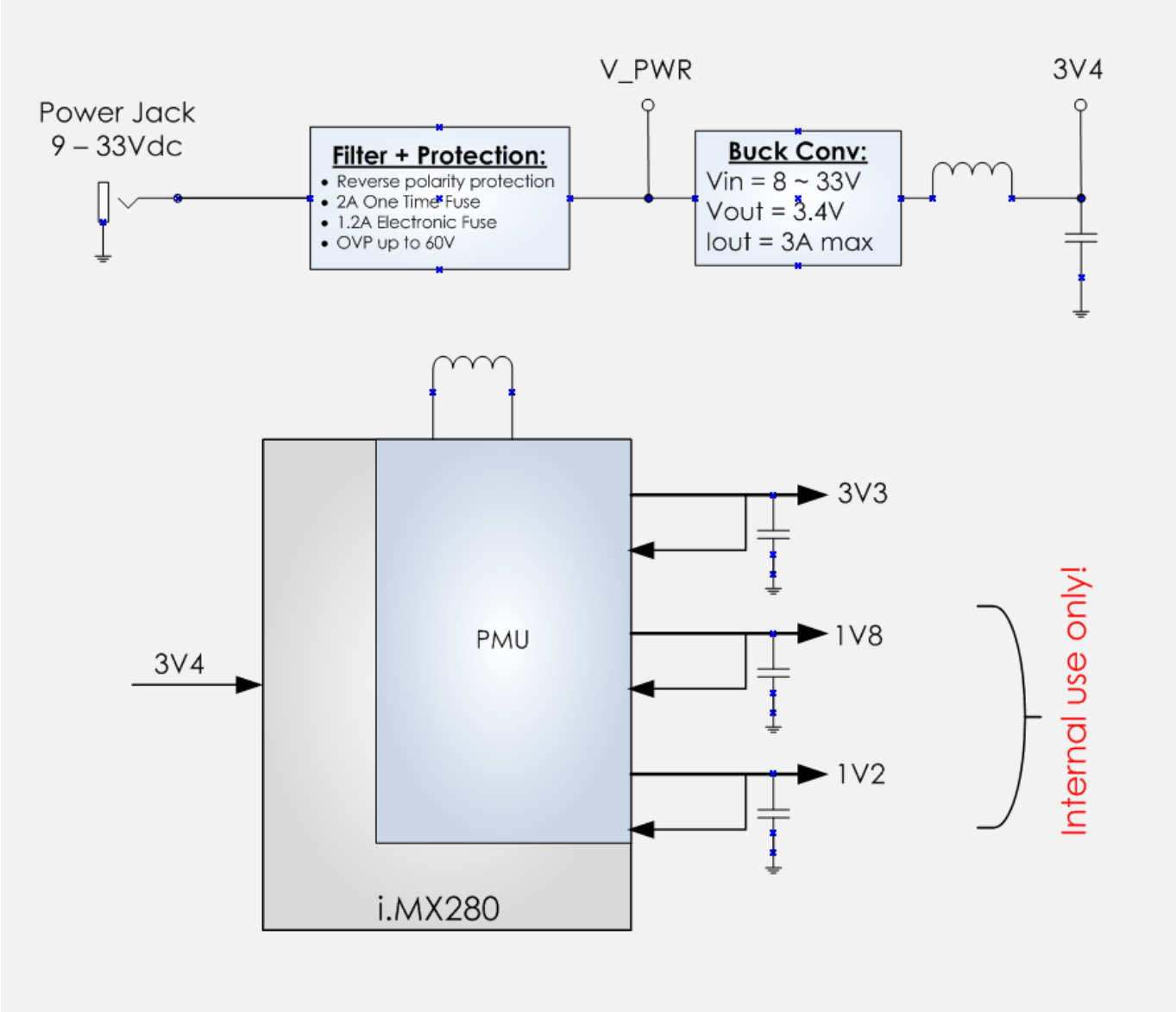
Low power circuit generated by the micro controller

- Provides three voltage rails for very limited power:
    - 3V3: A 3.3V power rail provided by the micro controller is used on the mainboard and also accessible to the expansion boards
    - 1V8: A 1.8V power rail provided by the micro controller and only used on the main board
    - 1V2: A 1.2V power rail provided by the micro controller and only used on the main board

Voltage Rail	Voltage	Usage	Max Current
V_PWR	Equals the voltage applied by the power adapter, minus the drop over the protection circuit	Use for power-hungry devices	Current is limited to 1.2A
3V4	3.4V	Powers all standard digital components on the expansion cards	3A maximum of which the main board is already using 1.5A. Only 1.5A is left for both expansion cards. (The sum of both expansion cards should be lower than 1.5A)
3V3	3.3V	Powers low power components or level	The DC/DC Converter is a triple

		translators, e.g. between I/O signals from the processor and circuitery on the main board or on the expansion cards	output buck converter (3V3, 1V8 and 1V2). The maximum output current capability of each output of the converter is dependent on the loads on the other two outputs.
1V8	1.8V	Internal use on the main board only	Internal use only
1V2	1.2V	Internal use on the main board only	Internal use only

Internal Power Circuits Block Diagram


Power Jack
9 – 33Vdc
Filter + Protection:
• Reverse polarity protection
• 2A One Time Fuse
• 1.2A Electronic Fuse
• OVP up to 60V
V_PWR
Buck Conv:
Vin = 8 ~ 33V
Vout = 3.4V
Iout = 3A max
3V4
3V4
PMU
3V3
1V8
1V2
i.MX280
Internal use only!

SIM Card Requirements

The CloudGate has an integrated (U)SIM interface compatible with the ISO7816 IC card standard. The 3GPP standard defines three operational voltages for the supply voltage of the SIM card: 1.8V, 3V and 5V. The CloudGate supports two voltages: 1.8V and 3V. The 5V-only SIM cards are rarely used and are not supported by the CloudGate.

General requirements:

- Changing of SIM cards while in operating mode, the so called "SIM card hot-swapping", is not supported.
- Detection of the SIM card removal can take up to 30 seconds.
- The CloudGate will not be able to communicate with the SIM card after re-insertion. As a result, the CloudGate needs to be reset after re-insertion of the SIM.

Learn how to install a SIM card.

Reset Button

On the back side of the unit there is a reset button behind the hole in the top panel (indicated by the "2" in the picture above).

This button allows to restart the unit or to reset it to the factory settings:

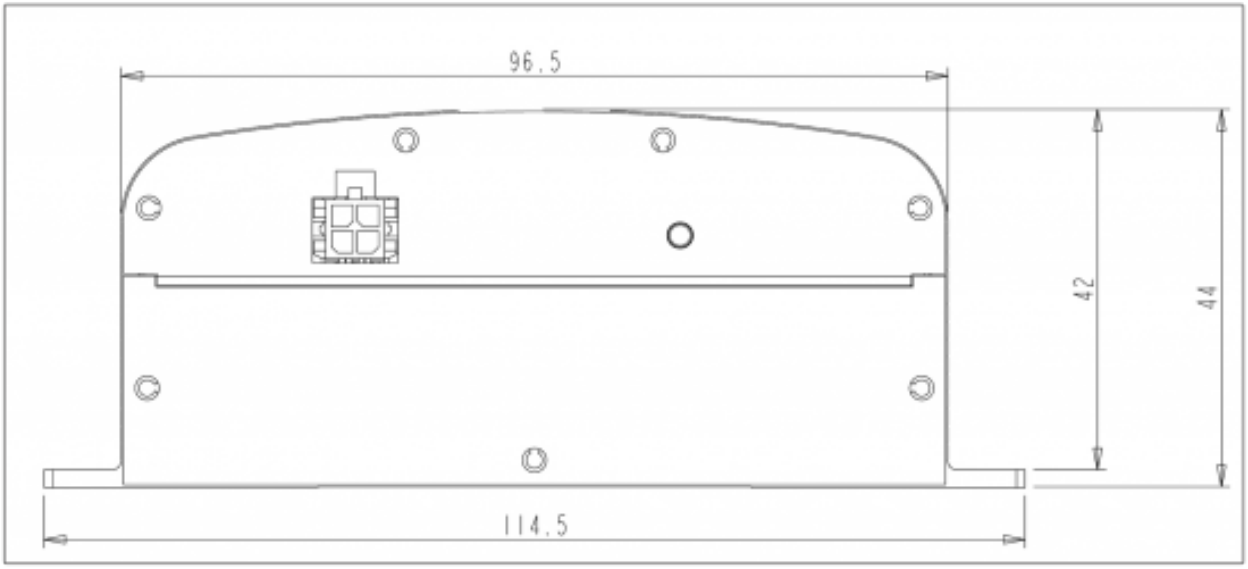
- press and hold for less than ten seconds to reset the unit to the last working settings,
- press and hold for ten seconds or more to reset the unit to factory settings.

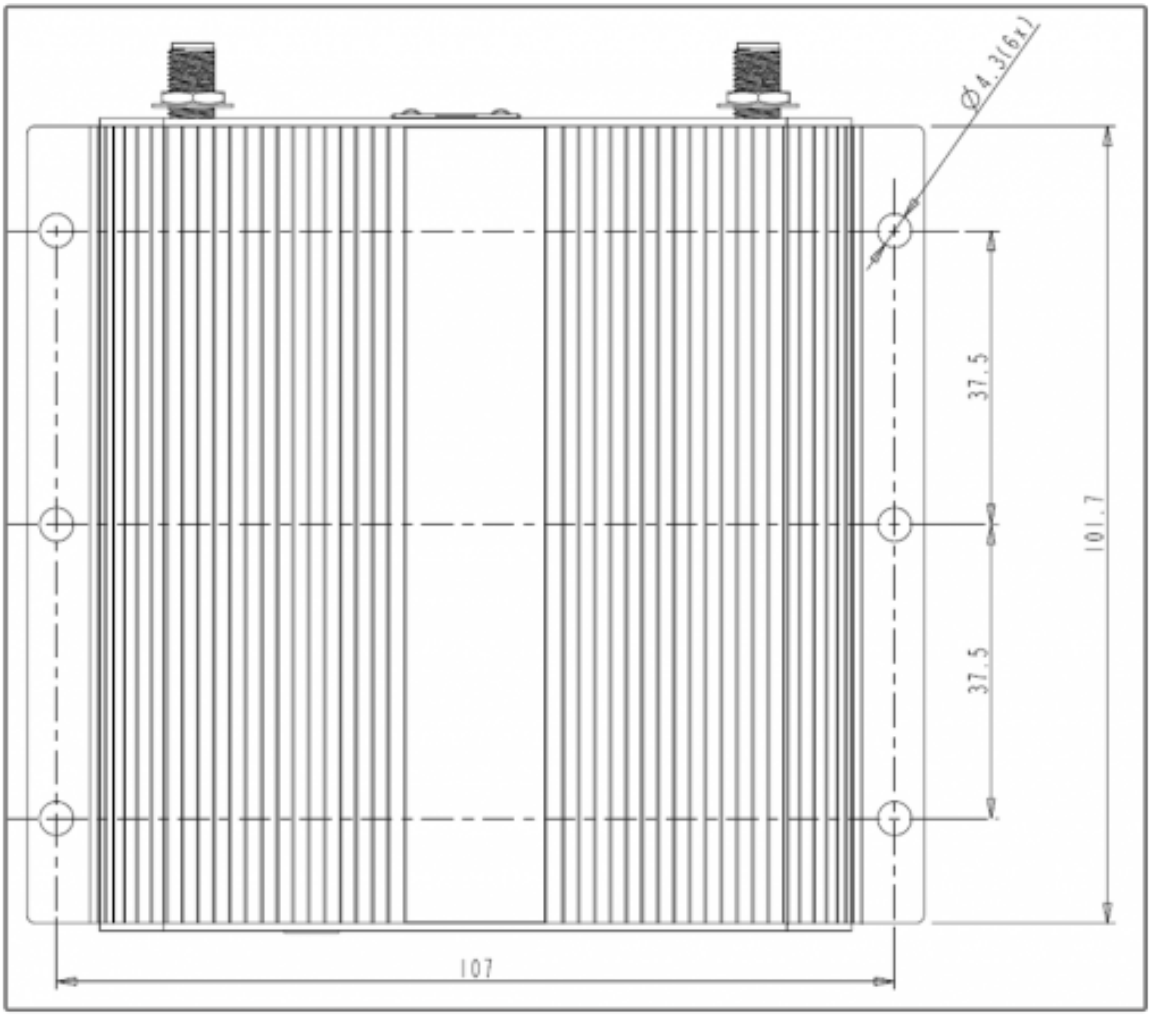
Mechanical Drawings

- 3D file of the CloudGate.
- 3D file of the front plate of the expansion cards [1]

Please reach out to cgdeveloper@option.com if you want to have access to the 3D files of the CloudGate or CloudGate front/rear expansion cards.

Below you can find the dimensions of the CloudGate.





The 6 mounting holes in the CloudGate housing allow mounting on a wall or on a DIN rail. See the details in the "Mounting" section of the CloudGate Installation Guide.

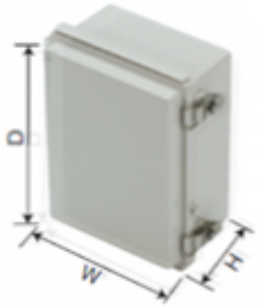
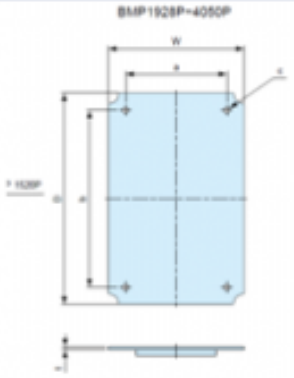
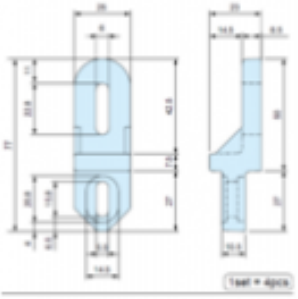
Note 1:
The front plate for the expansion cards, both at the front and at the back side of the CloudGate, are identical.

IP-65 Requirements

Below you can find the parts for the encasing which are needed to fulfill the requirements for IP-65.

All these parts can be ordered by TAKACHI:

- 1x box BCAK 203013G or BCPK 203013S,
- 1x plate BMP 2030P,
- 1 x screws (20pcs) MT4-8T,
- 1x bracket (2x4 pcs) BLF-2G(PC-GF) or CK-26P (metal SS)
- 3x cable gland MG-12S (3 inputs)

Encasing M2M box			
			or
Box		**BCAK 203013G (ABS+Key)UL94HB** WxDxH 200x300x131,5	**BCPK 203013S (PC + Key)UL94VO** WxDxH 200x300x131,5
Plate		**BMP 2030P (ABS)** WxDxt 166,5x266x4	
screws		**MT4-8T** 20PCS M4 tapping	
Bracket		**BLF-2G (PC-GF)** 4 Mounting brackets 4 screws M5x12	**CK-26P (metal SS)** 4 Mounting brackets 4 screws M5x10
Cable gland		**MG-12S** **Ø12** cable range Ø3-6,5mm	

Environmental Specifications

- Operating temperature: -30°C to 70°C (*) see Safety Warning below
- Storage temperature: -40°C to 85°C
- Humidity operational: 5% - 95% non condensing
- Operating altitude: up to 2000m

Safety Warning
When the device is installed in a location where the environmental temperature can rise above 60°C, the temperature of the surface might reach high values and therefore under these conditions the user needs to warned in order to prevent accidental contact. For this purpose the device has to be installed in a restricted access location and a warning sticker, in accordance with IEC 60417-5041 (DB:2002-10), must be applied on a visible part of the unit.

CloudGate MTBF Determination

Theoretical Approach

Modus Operandi

The theoretical determination of the MTBF is based on the accumulation of the FIT (Failure in Time) numbers of all components used in the CloudGate assembly.
FIT numbers have been provided by component manufacturers or estimated in case FIT numbers were not available (based on comparable components).
FIT numbers for electronic components are determined at +55°C; hence the resulting MTBF figure is valid for an operating temperature of +55°C.
MTBF figures corresponding with different operating temperatures are calculated through the use of acceleration factors, determined through the Arrhenius equation.

$$A_f = e^{\frac{E_A}{k}\left[\frac{1}{T_{field}} - \frac{1}{T_{test}}\right]}$$

$E_A = 0{,}6$ eV

MTBF Based on FIT

Sum of the component's failure rates: $\square_i$ (n.$\square_i$)= 4241,31 (failures per 10^9 operating hours)

- n = number of identical components
- $\square$i = FIT number for a component type

Resulting $MTBF_{55(*)}$ □ 235.800h or 26,9y

Results for different operating temperatures (using A_f):

- $MTBF_0$ □ 16.907.533h or 1930,1y
- $MTBF_{10}$ □ 6.872.155h or 784,5y
- $MTBF_{20}$ □ 2.970.165h or 339,1y
- $MTBF_{30}$ □ 1.356.761h or 154,9y

- $MTBF_{40}$ □ 651.566h or 74,4y
- $MTBF_{50}$ □ 327.438h or 37,4y
- $MTBF_{60}$ □ 171.490h or 19,6y
- $MTBF_{70}$ □ 93.265h or 10,6y

(*) The index indicates the temperature for which the MTBF is valid.

Practical Approach

Modus Operandi

Accelerated Life Test

The practical approach towards the determination of the MTBF exists in the conduction of an Accelerated Life Test.
10 units are subjected to a test environment of high temperature and high relative humidity. The difference between the test environment and the normal operating conditions lead to an acceleration factor that allows making a projection of the MTBF of the product.
For this ALT, the following test conditions were used:

- Units are put in a VC4034 climate chamber:
    - +70°C & 85%RH for 798h
    - +75°C & 85%RH for 1093h
- All devices continuously made 3G calls at an output power of +3dBm (50% duty cycle regime, 24h-cycles).
- Power is toggled off & on every cycle.
- All units were connected to a 12V power supply.
- RF signals were wired to a switch that connected to 5 CMU200 radio communication testers.
- No failures were encountered during the tests.

Calculations

Acceleration Factor
The formula for calculation of the acceleration factor, induced by both elevated temperature and elevated relative humidity, is based on the Arrhenius equation:
EA = 0,6 eV
b = 5,57x10-4

MTBF

The formula for calculation of the MTBF:

- S: sample size

- t: test time (h) multiplied by acceleration factor
- $x^2/2$: chi-square value corresponding with a 90% confidence level and zero failures
    - $x^2/2$= = 2,30

MTBF Based on ALT

Confidence level = 90%.
Nominal ambient relative humidity = 50%.

- $MTBF_0$ □ 24.767.294h or 2827,3y
- $MTBF_{10}$ □ 10.066.796h or 1149,2y
- $MTBF_{20}$ □ 4.350.898h or 496,7y
- $MTBF_{30}$ □ 1.987.475h or 226,9y
- $MTBF_{40}$ □ 954.458h or 109,0y
- $MTBF_{50}$ □ 479.653h or 54,8y
- $MTBF_{60}$ □ 251.210h or 28,7y
- $MTBF_{70}$ □ 136.621h or 15,6y

Because no failures were observed during the test, the achieved numbers can be taken as a conservative estimate of the product's MTBF.

Shock Resistance

The next tests have been performed on the CloudGate and passed:

- EUT state: operational
- Frequency range: 10 … 2000Hz
- Overall acceleration: 3.6Grms
- Crest Factor: 3
- Orientation: 3 axis, X / Y / Z
- Test duration: 94 hours / axis
- Profile: See PSD table on 'additional info' sheet

Test	Details	Spec number
Resonance search and dwell (Search for critical resonances and stress these to verify the reliability of the EUT.)	• EUT state: operational • Frequency range: 10 … 2000Hz • Overall acceleration: 3.6Grms • Crest Factor: 3 • Orientation: 3 axis, X / Y / Z • Test duration: 94 hours / axis • Profile: See PSD table on 'additional info' sheet	IEC 60068-2-6
Vibration endurance (Simulate rough conditions over lifetime.)	ISO 16750-3	IEC 60068-2-53
Shock Vibration (Bump) (Simulate rough handling.)	• EUT state: operational • Acceleration: 10gn • Pulse width: 11ms • Waveform: Half-sine • Amount of bumps: 100 / axis • Orientation: 3 axis, X / Y / Z	IEC60068-2-27
Guided drop test (Simulate impact caused by dropping the device.)	• EUT state: Non-operational • Drop height: 150cm • Drop surface: concrete floor • Amount of impacts: 6 (1 per orientation) • Orientation: 6 axis, X+/X- / Y+/Y- / Z+/Z-	IEC60068-2-31

Certification information for CloudGate 3G Americas

Model: CG0192

This page offers an overview of the country certifications and operator approvals obtained per region. This CloudGate model is approved for use in the countries listed below. For use in other countries, please consult your sales contact.

- Brazil
- Canada
- Chile
- Colombia
- El Salvador
- Mexico
- Peru
- United States

Before installing your CloudGate device, read the Safety Guidelines section in the CloudGate Installation Guide carefully. Not following these guidelines can cause harm to the CloudGate, yourself or other persons.

Brazil ANATEL

The CloudGate 3G Americas can be used in Brazil and complies with Anatel requirements.

Canada IC

The CloudGate 3G Americas can be used in Canada and complies with the applicable Industry Canada regulations.

The product completed PTCRB certification and was approved by the following network operators:

- Bell Mobility
- Telus

The CloudGate 3G Americas can be used in Class I Div 2 Hazardous Locations. Click here for conditions for use.

INDUSTRY CANADA REGULATIONS

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

External antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter, IC 2734A-MO6892, has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

To comply with Industry Canada regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain must not exceed:

- 4.0 dBi in Cellular band (800MHz)
- 3.5 dBi in PCS band (1900MHz)
- 3.5 dBi in AWS band (1700MHz)

In addition the product shall be installed in a way that a distance of at least 20 cm is maintained between the antennas and the user’s body.

REGULATIONS INDUSTRIE CANADA

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Antennas externes

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut

fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risqué de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio, IC 2734A-MO6892, a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

- 4.0 dBi dans la bande cellulaire (800MHz)
- 3.5 dBi dans la bande SCP (1900MHz)
- 3.5 dBi dans la bande AWS (1700MHz)

En plus, le produit doit être installé de manière à assurer une distance de séparation de 20 cm minimum entre le corps de l'utilisateur et les antennes.

Chile

Subsecretaría de Telecomunicaciones

The CloudGate 3G Americas can be used in Chile and complies with the SUBTEL requirements.

Colombia

CRC Comisión de Regulación de Comunicaciones

The CloudGate 3G Americas can be used in Colombia and complies with the CRC requirments.

The certificate can be found here.

El Salvador

SIGET

The CloudGate 3G Americas can be used in El Salvador and complies with the SIGET requirements.

The certificate can be found here.

Mexico

The CloudGate 3G Americas can be used in Mexico and complies with the IFETEL and NOM requirements. It carries the IFETEL number RTIOPCG14-0272 and is marked with the NOM NYCE mark.

The product completed PTCRB certification and was approved by the following network operator:

- Telcel

The IFETEL certificate can be found here.

IFETEL

La operación de este equipo está sujeta a las siguientes dos condiciones:
(1) es posible que este equipo o dispositivo no cause interferencia perjudicial y
(2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Peru

The CloudGate 3G Americas can be used in Peru and complies with the MINTC requirements.

The certificate can be found here.

United States

The CloudGate 3G Americas can be used in the USA and complies with the applicable FCC rule parts.
The product completed PTCRB certification and was approved by the following network operators:

- Aeris
- AT&T
- Sprint
- T-Mobile
- Verizon Wireless
- US Cellular

The CloudGate 3G Americas can be used in Class I Div 2 Hazardous Locations. Click here for conditions for use.

FCC REGULATIONS

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Federal communications commission notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Exposure Information to Radio Frequency Energy

Users concerned with the risk of Radio Frequency exposure may wish to limit the duration of their calls and to position the antenna as far away from the body as is practical.

Modifications

Any changes or modifications made to this device that are not expressly approved by Option could void the user's authority to operate the equipment.

External antennas

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain must not exceed:

- 4.0 dBi in Cellular band (800MHz)
- 3.5 dBi in PCS band (1900MHz)
- 3.5 dBi in AWS band (1700MHz)

In addition the product shall be installed in a way that a distance of at least 20 cm is maintained between the antennas and the user’s body.

Class I Div 2 Hazardous Locations

Model: CG0192

Expansion card models CG2101, CG1102, CG1106, CG3102

This page offers information on using your CloudGate product in Class I Div 2 Hazardous Locations in the countries listed below. For use in other countries, please consult your sales contact.

Please read the safety guidelines carefully. Not following these guidelines can cause harm to the CloudGate, yourself or other persons.

Canada & United States

The CloudGate 3G Americas can be used in Canada and the United States and was tested under following standards:

- CSA C22.2 No. 213-M1987 "Non-incendive electrical equipment for use in class I, division 2 hazardous locations"
- ANSI/ISA-12.12.01-2013 "Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations"

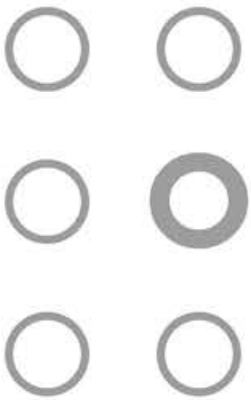
The above mentioned model can only be used in Hazardous Locations when marked with the 'MET RECOGNIZED" logo. The above mentioned expansion card models can only be used when marked with the text "C1D2" on the label. Other existing CloudGate models and other expansion cards that are not present in the list above, shall not be used in hazardous locations.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only.

- Hazardous locations safety guidelines
- Normal locations safety guidelines

UL60950

The CloudGate 3G Americas was successfully tested against the UL60950-1 safety standard.



OPTION

WIRELESS TECHNOLOGY