CTM-500 MANUAL

Product	CTM-500
Revision	Revision 1.0

MANUAL: CTM-500
3066 Beta Avenue | Burnaby, B.C. | V5G 4K4

Revision Control

Description	Initials	Rev	Date
Initial Release	CC	1.0	28-OCT-2022

Table of Content

1. Notice

Due to the nature of wireless communication, the reception or transmission of data can never be guaranteed. Data may be delayed, corrupted, or never received. Data transfer problems are rare with well-constructed and configured wireless networks used in conjunction with devices such as the CTM-500 wireless gateway Cypress Solutions Inc. accepts no responsibility for damages of any kind including, but not limited to personal injury, death, or loss of property due to the delay or loss of data resulting from the use of the CTM-500 wireless gateway.

1.1 Operation in hazardous/restricted environments

Wireless transmitters can cause interference with some critical operation equipment. For this reason, it is required that the RF portion of the CTM-500 wireless gateway be turned off when in the vicinity of blasting operations, medical equipment, life support equipment, or any other equipment that is susceptible to radio interference. The CTM-500 wireless gateway must be turned off when on-board or in the vicinity of any aircraft. The FAA prohibits the use of wireless transmitter equipment at any time during aircraft flight.

1.2 Regulatory restrictions

CAUTION: Any modifications to the CTM-500 wireless gateway not expressly authorized by Cypress Solutions Inc. may cause its regulatory approval status to become invalidated, thereby voiding your authority to use the product.

The CTM-500 wireless gateway contains a wireless module approved under FCC CFR 47 part 2.1091 and Industry Canada RSS-102 rules for operation as a mobile or fixed device with its specified antenna of gain ≤6dBi and from which a separation distance of at least 20 cm (8”) must be maintained from all persons at all times and during all modes of operation. Internal antennas are not available, when external antennas are used, the antennas used must not be co-located or operated in conjunction with any other antenna or transmitter. These rules are in place to prevent any possible hazard due to personal exposure to electromagnetic radiation.

CTM-500 devices are designed to operate with the approved wireless module installed. The module has its own FCC and Industry Canada approval ID number.

1.3 Electromagnetic Interference (EMI) – United States FCC Information

This equipment has been tested and found to comply with limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that harmful interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving/transmitting antenna(s)
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

1.4 Electromagnetic Interference (EMI) – Canada Information

This digital apparatus does not exceed the class B limits for radio noise emissions from digital apparatus as set out in the interference causing equipment standard entitles “Digital Apparatus”, ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques”, NMB-003 édictée par le Ministre des Communications.

1.5 Trademarks

All brand or product names, trademarks, logos, etc. used in this manual are owned by their respective companies.

2. Product Overview

The CTM-500 is the next generation wireless gateway that is built with an advanced processor to process data at the highest speed. With the option of LTE-A or 5G connectivity for fixed site or mobile applications, the CTM-500 can integrate seamlessly into any environment.

FRONT

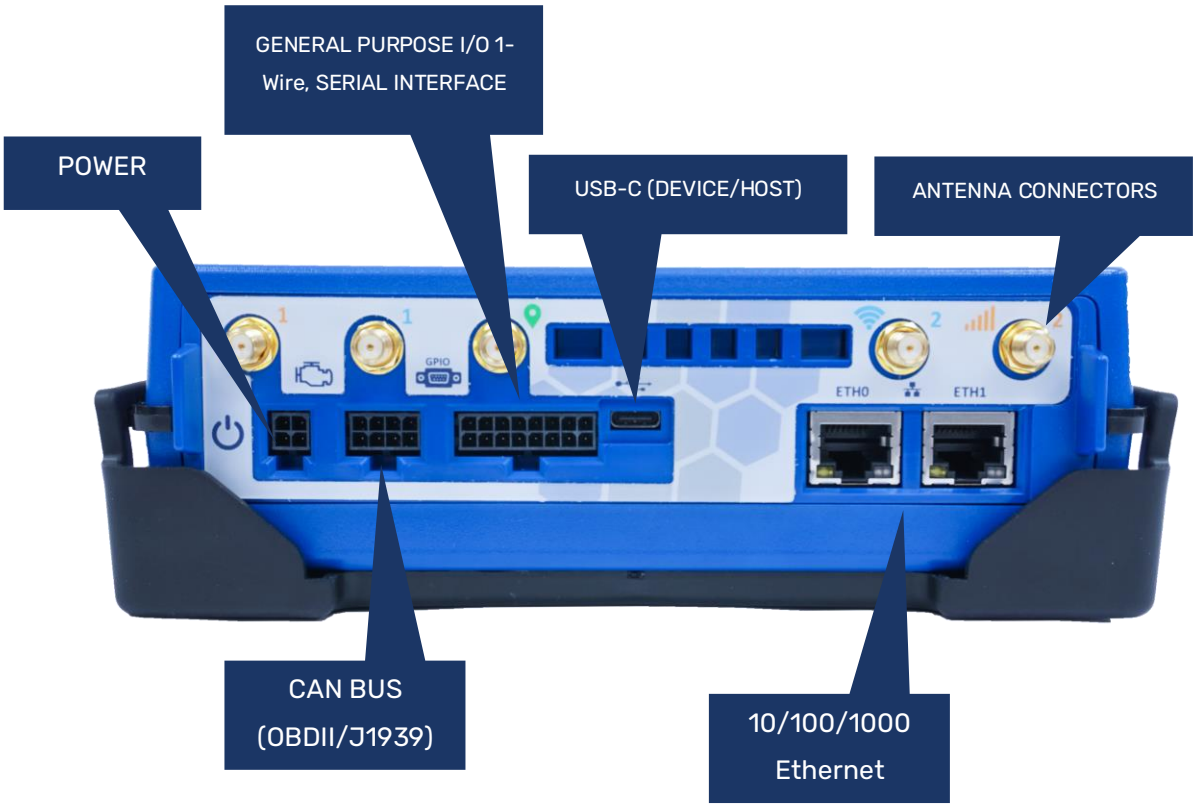
BACK

3. Physical Interfaces

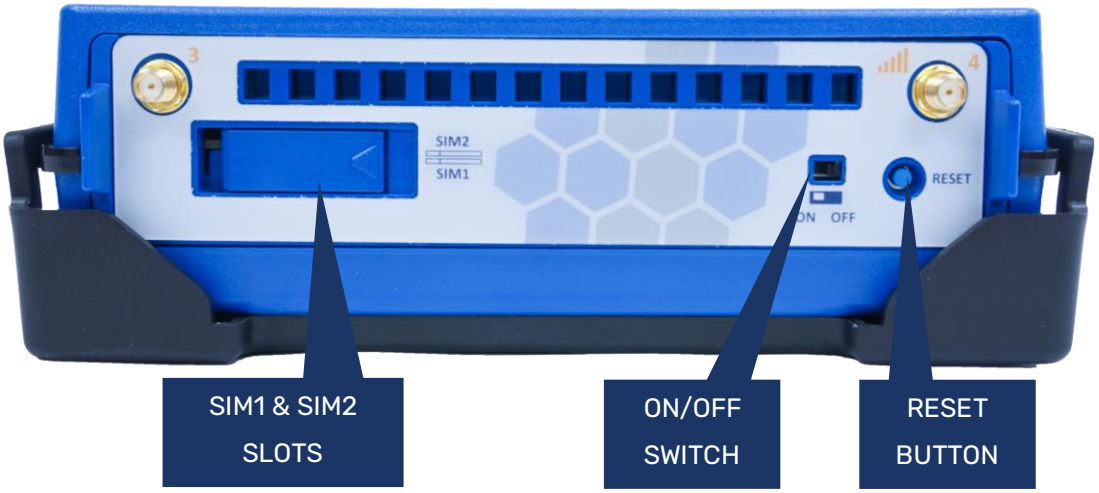
- Power connector with ignition sense (4 pins)
  - 7-32 VDC with Transient (spike) protection
  - Typical current draw 400mA @ 12V
  - Standby/suspend mode
- 2x RJ-45 Gigabit Ethernet Ports
  - ETH0 (Ethernet 0) – supports PoE (802.3 at) with external battery accessory
  - ETH1 (Ethernet 1)
- Engine Diagnostic Port (ECU) (8 pins)
  - Dual CAN interface
  - supports OBD-II (ISO15765-4) and J1939 supported vehicles
- *General Purpose Input and Outputs (GPIO)/Serial/1-Wire® (16 pin)
  - Inputs x 4
  - Outputs x 4
  - RS232 (Receive/Transmit)
  - 1-Wire® interface
  - Protected (fused) power output

- USB-C Dual Role Port
- Multiple RF connectors
    - Threaded SMA style for Cellular and GPS
    - RP-SMA style for Wi-Fi
- ON/OFF Switch
    - The switch is used to turn the device on and off.
- Reset button
    - Used for rebooting or resetting the device to failsafe and factory configurations
- Dual SIM card slot
    - Support for two 2FF (mini) SIM cards

*Refer to Appendix 2 and 3 for further detail.



PHYSICAL INTERFACE - FRONT



PHYSICAL INTERFACE - BACK

4. SIM Card Installation

The CTM-500 supports two mini 2FF style SIM cards. One or two SIMS can be installed.

For single SIM card installation, the SIM card may be inserted into either slot, labelled SIM1 and SIM2.

'SIM2' slot is located at the top and 'SIM1' slot is located at the bottom.

4.1 SIM card insertion and removal

1) Unlock the SIM card door by sliding it to the left until the door unlocks, then swing the door open.
2) For single SIM card installation, insert the SIM card into either of the slots of the dual SIM holder. Ensure that the copper contact is facing upwards (chamfered corner to the front left).
3) If applicable, the second SIM card can be inserted into the other slot of the dual SIM holder.
4) Close the SIM door securely by sliding it to the right until a 'click' is heard.

Please refer to the video guide as an additional resource here.

4.2 SIM Removal Tool

The SIM removal tool is used to facilitate the removal of SIM cards. The tool is included with every CTM-500 device shipment. The opposite end of the SIM removal tool also serves as a main fuse removal tool.

SIM REMOVAL TOOL

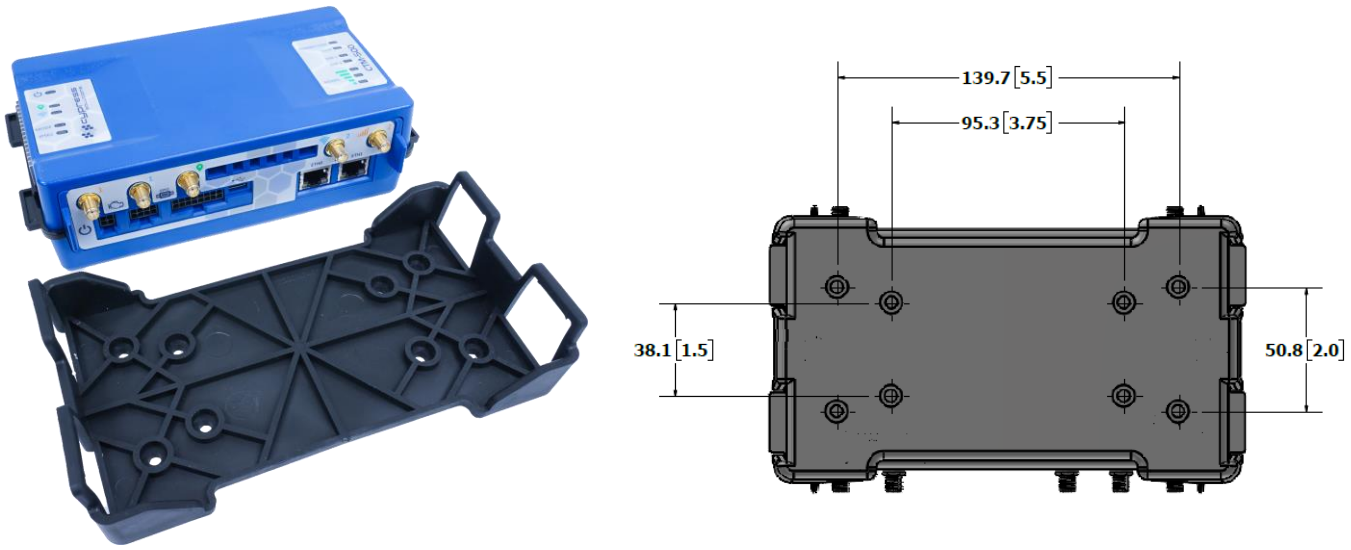
5. CTM-500 Installation

Select an installation location that will provide optimal cable routing for external connections for power and antennas and other accessory equipment such as vehicle Engine Control Unit (ECU) and General Purpose I/O. Ensure the location of the CTM-500 is free from dust or moisture and cabling is protected from accidental disconnect or damage.

5.1 Physical Mounting

The CTM-500 includes a flexible, shock absorbing mounting bracket that has eight 5mm (3/16”) diameter mounting holes suitable for M5 or #10 screws. Use either the outer or inner 4-hole mounting pattern to secure the bracket. Take care not to over-tighten. Clip the CTM-500 into the 4 tabs of the bracket.

The bracket can be used as drill template. This hole pattern matches the legacy Cypress Solutions devices, (CTM-200 and Oxygen 3 Plus) so no extra holes are required.



MOUNTING BRACKET

5.2 Connect External Antennas

The CTM-500 requires external antennas for Cellular/GNSS(GPS) and Wi-Fi. Antennas should be selected based on the application and operating environment. Cellular and GNSS(GPS) antenna ports are SMA bulkhead connectors. Wi-Fi antenna ports are reverse polarity RP-SMA.

Antennas should be mounted in such a position as to maintain a separation distance from any person of at least 20cm (8”). If the location features of the product (GNSS/GPS) are used, mount the GPS antenna in a position that is exposed to a clear line of sight view of the sky.

5.3 Cellular (4x4 MIMO)

For 5G connectivity, connect all 4 cellular ports labeled 1-4 to suitable antenna(s) that support 4x4 MIMO or use individual “stubby” style antennas.

For 4G/5G connectivity, antennas should support frequencies from **617-960/1710-6000 Mhz.**

5.4 Wi-Fi (2x2 MIMO)

For Wi-Fi connectivity, connect the 2 cellular ports labelled 1-2 to suitable antenna(s) that support 2x2 MIMO or use individual “stubby” style antennas.

The CTM-500 supports 2.4 Ghz and 5 Ghz Wi-Fi, so select an antenna that supports **2.4/4.9-6 Ghz.**

5.5 GNSS/GPS (1x1)

The GNSS/GPS antenna should be an active antenna. The antenna installation should be on an upper horizontal surface of a vehicle or building with a clear 360-degree view of the sky.

For best performance, select a GPS antenna that supports GPS/Glonass/Beidou/Compass/Galileo/QZSS (GNSS) constellations that support the frequency range **1562-1612 Mhz.**

Please contact Cypress Solutions for assistance in selecting the appropriate antennas.

6. Power

Please connect the CTM-500 to a suitable power supply. There are three options for powering the CTM-500:

- DC Power supply (refer to appendix 1 for more detail)
- Power over Ethernet (PoE)
- Vehicle ECU (OBDII/J1939)

6.1 DC Power Supply

Power can be supplied to the CTM-500 using an AC/DC wall adaptor to provide power to the device continuously. A DC power cable can also be connected to a DC power source between 7-32 VDC. Ignition line detection is also available that supports the CTM-500 to enter standby/suspend modes for low power applications.

Connect a suitable power source to the 4-pin locking connector labelled with the power icon.

DC Power Cable Part Numbers:

Length	Part Number
3m (10ft)	6954.2063
4m (13 ft)	6954.2000
4.5m (15 ft)	6954.2031

AC Wall Adaptor part Number:

Description	Part Number
CTM-ONE/500 AC wall adaptor	6954.2019

6.2 Power over Ethernet (PoE)

Power can be supplied to the CTM-500 by using a compatible PoE (802.3 at) power supply. Connect the PoE power supply to the ETH0 port of the CTM-500.

Note: PoE is only supported on the CTM-500 with the optional battery pack module installed.

Description	Part Number
Accessory Battery Pack	11220.9910

6.3 Vehicle ECU (OBDII/J1939)

For vehicle applications, the CTM-500 can be powered using the vehicle ECU.

Cable Part Numbers:

Length	J1939 Part Number	OBDII Part Number
2m (6ft)	6954.2002	6954.2001
4.5m (15 ft)	6954.2029	6954.2028
6m (20 ft)	6954.2044	N/A

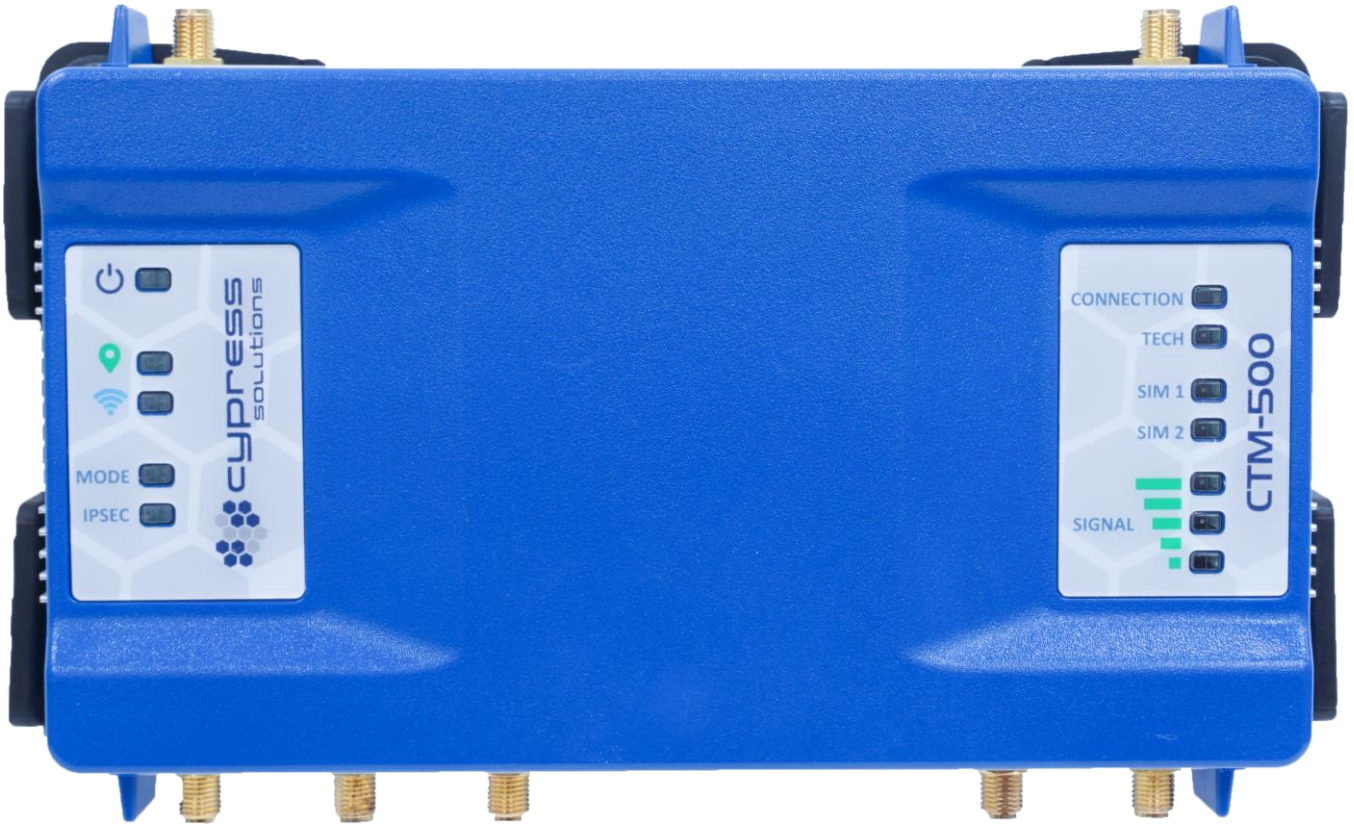
Ignition Cable (optional)*

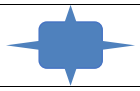
Length	Part Number
4.5m (15 ft)	6954.2052

*Ignition cable is only required for vehicles that cannot determine the ignition state from the vehicle ECU. Please contact Cypress Solutions for additional information.

7. LED Light Indicators

There are ten LED indicators on the CTM-500 wireless gateway.



LED	Status	Description
Power		(Solid) Normal powered operation
		(Flashing slowly) Standby mode
		(OFF) Device has no power
GNSS/GPS		(Solid) Valid position fix
		(Flashing slowly) no valid position fix
		(OFF) GNSS/GPS disabled
Wi-Fi		(Solid) Wi-Fi enabled
		(OFF) Wi-Fi disabled
MODE		(Solid) Pass through mode enabled ETH0
		(Flashing slowly) Pass through mode enabled ETH1
		(OFF) Pass through mode disabled
IPSEC		(Solid) IPSEC ENABLED, and all tunnels CONNECTED
		(Flashing slowly) IPSEC ENABLED, not all tunnels are CONNECTED
		(OFF) IPSEC disabled
CONNECTION (Cellular)		(Solid) Cellular connected
		(Flashing quickly) Cellular connecting
		(Flashing slowly) Cellular not connected/idle
		(OFF) Cellular connectivity disabled

LED	Status	Description
TECH		(Solid) 5G
		(Flashing slowly) LTE/3G
		(OFF) no cellular registration
SIM 1		(Solid) SIM1 Selected and Detected
		(Flashing slowly) SIM1 Selected, NOT Detected
		(OFF) SIM1 not selected to be used
SIM 2		(Solid) SIM2 Selected and Detected
		(Flashing slowly) SIM2 Selected, NOT Detected
		(OFF) SIM2 not selected to be used

***Note**: When Cellular data is disabled, the following will be OFF: CONNECTION, TECH, SIM 1, SIM 2, and all three Cellular lights.

LED	Status	Description
Cellular 		Poor Signal (Solid or flashing)
		Good Signal (Solid or flashing)
		Excellent Signal (Solid or flashing)

8. Configuration

The CTM-500 can be configured via ethernet or Wi-Fi (if enabled). Depending on the "shipped" configuration, this step may be optional. All configurations can also be performed remotely via Cypress IOT device management platform.

8.1 Access via Ethernet

Plug one end of a standard Ethernet patch cable into one of the CTM-500's Ethernet port, and the other end into the LAN device, PC or Ethernet peripheral. The Ethernet port is compatible with 10/100/1000Base-T connection types. The Ethernet port support auto MDI/MDIX. This means no Ethernet crossover cable will be needed whether the CTM-500 is connected to a router or to a computer.

Ethernet Port	Default IP (https)	Default Secondary IP	Username	Password
ETH0	192.168.1.1	169.254.0.1	admin	See label
ETH1	192.168.2.1	169.254.0.129	admin	See label

You will be required to change your password during the first login attempt.

Note: password must contain a combination of letters, numbers, or special characters. No dictionary words are permitted.

The default password will be printed on the label attached to the CTM-500.

Ethernet access can be disabled but before disabling ethernet access make sure you have confirmed alternate access via other mechanisms, for example, Cypress IOT.

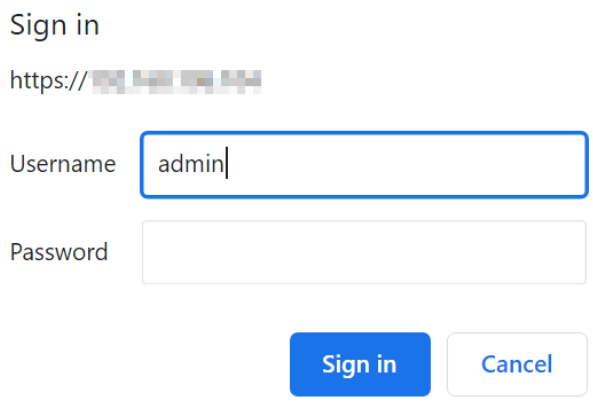
8.2 Access via Wi-Fi

Refer to the table below for access via username/password.

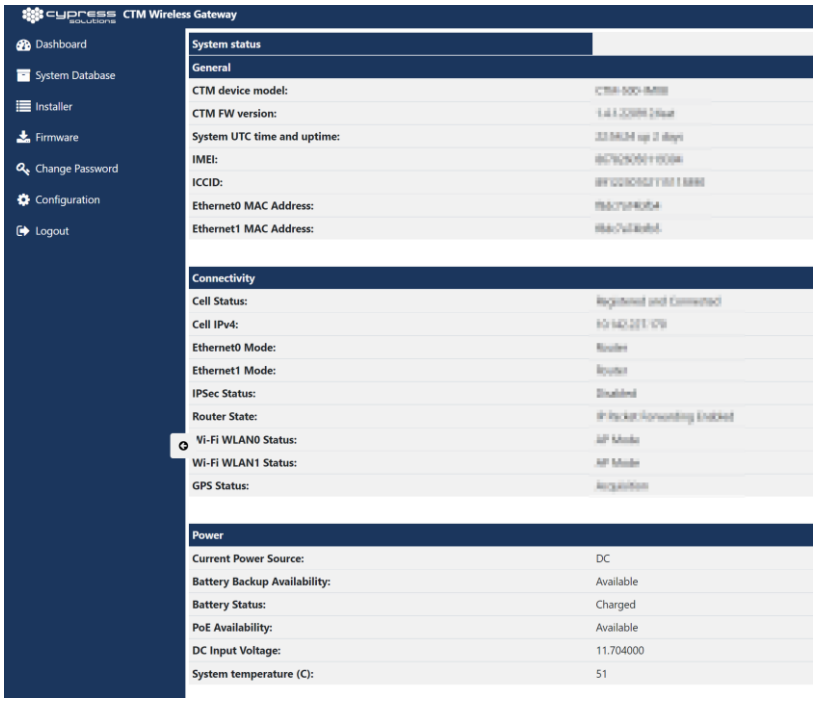
Interface	Technology	Default IP (http)	Default SSID	key
Radio 0	**2.4 GHz**	192.168.3.1	CypressCTM	CypressAccess
Radio 1	**5/6 GHz**	192.168.4.1	CypressCTM-5G	CypressAccess

Wi-Fi access can be disabled in the modem configuration if required.

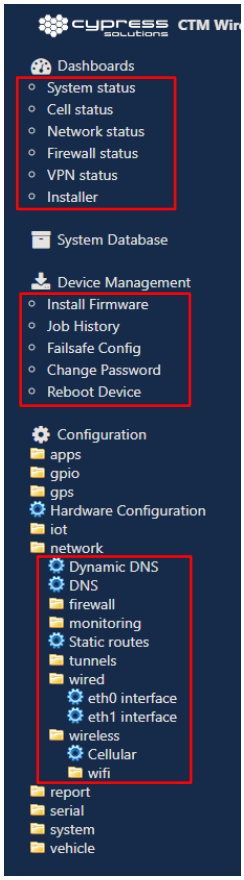
After connecting to the modem Wi-Fi network, you will be prompted to change your password if you attempt to access the modem via 192.168.3.1 or 192.168.4.1.



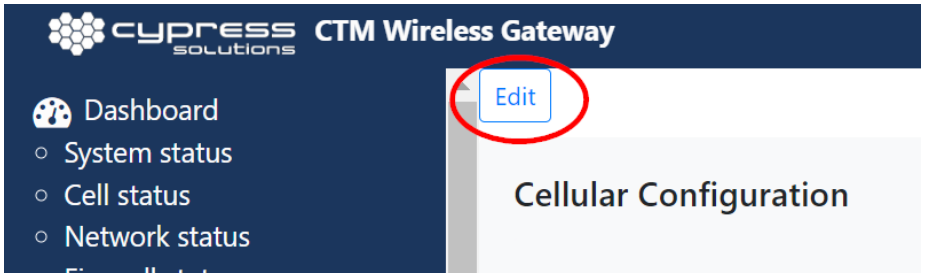
You will see this screen after a successful login:



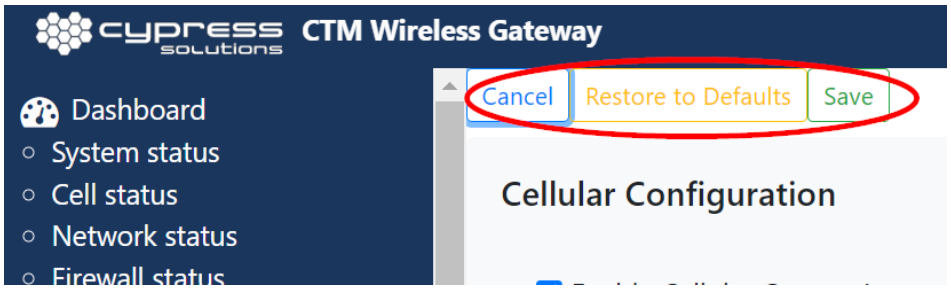
The left-most column contains expandable tree items for configuration.



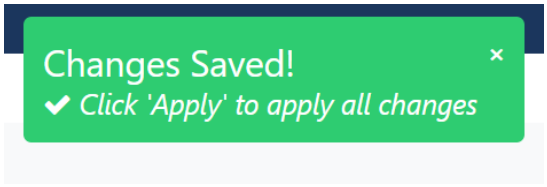
Clicking the Edit button enables changes to the configuration to be made:



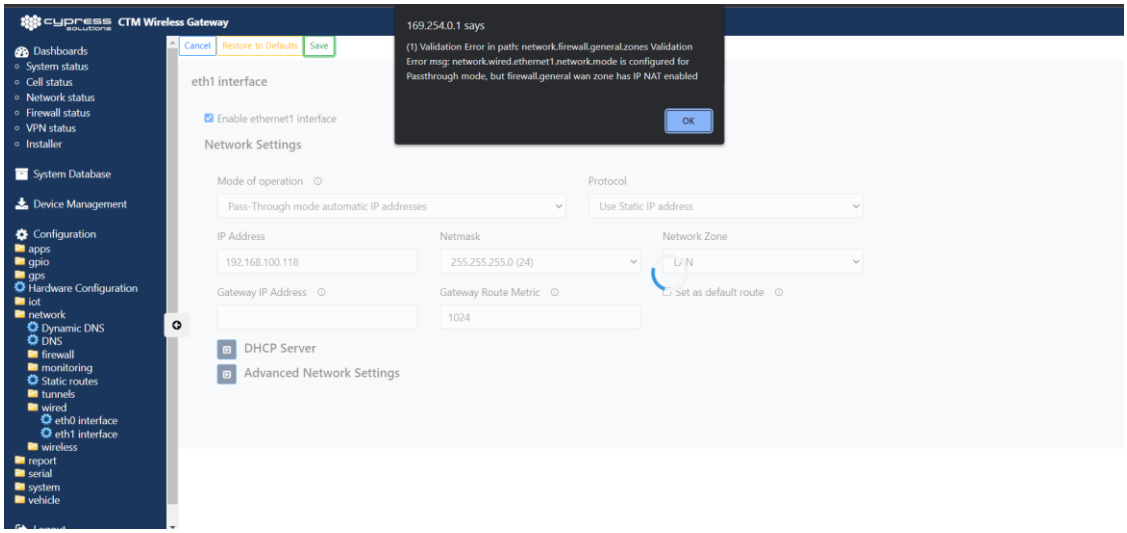
Cancel, restore to default, or save any changes made to a page.



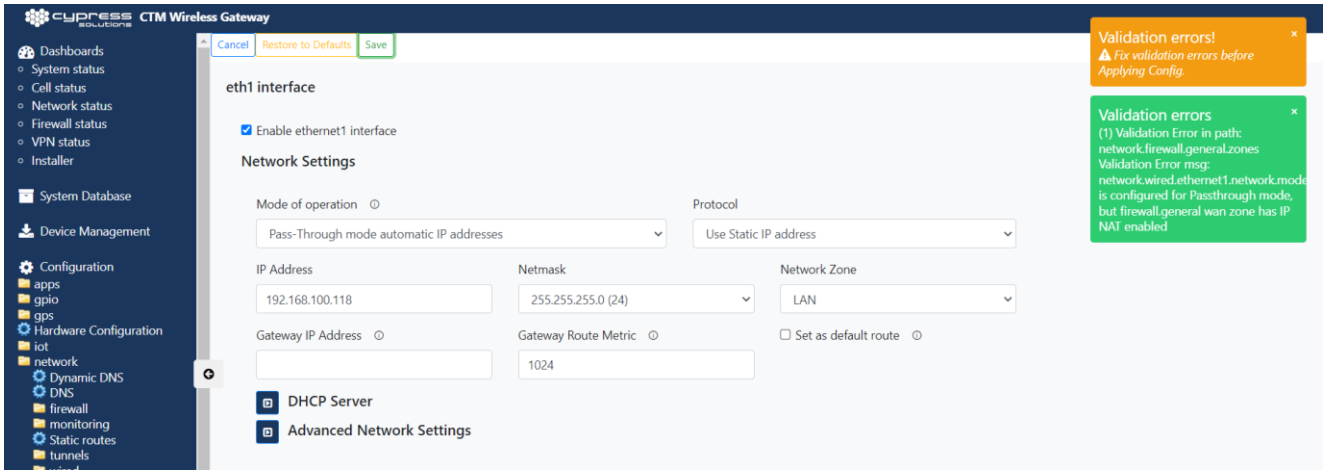
Make sure to save changes to a page/tab before leaving and moving to another page/tab. After saving changes, you will see:



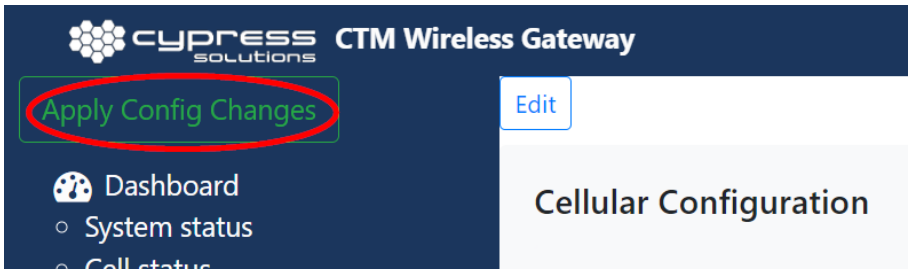
There is the possibility of an error pop-up when there is an issue with the configurations.



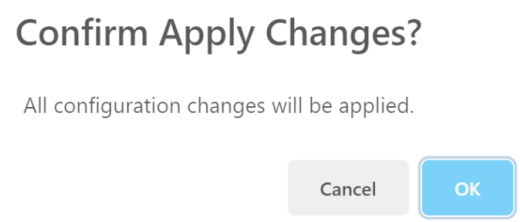
After clicking OK on the pop-up, the errors will display on the right in coloured boxes. Fix the validation errors first, then try saving again.



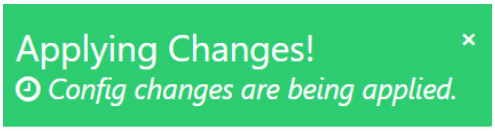
In the upper left of the browser. After saving, changes must be applied to take effect.



Confirm the changes:



After pressing the OK button, the following notice will appear in the upper right portion of the browser.



9. Power Management

9.1 Power Management Options

The CTM-500 wireless gateway has two power modes:

Mode	Current @ 12V	Description	Mode change event
Standby	10 mA	Device is in low power mode.	The device may spend most of its time in this mode, various configurable triggers will bring the device out of this mode into Operating Mode.
Operating	400mA	Device is operating, can communicate with peripherals, Serial, Ethernet, CAN, GPIO, GNSS	The device will go back into standby mode when the ignition/standby signal is deactivated or upon expiry of the power ON timer if configured.

Power Management is controlled either by Ignition or CAN Bus. The default configuration of the CTM-500 is to stay powered on continuously when connected to external power.

9.2 Power Accessory

The CTM-500 has an optional removable battery for short-term power in the case power is lost from the connection. This is not a standard accessory included with all devices.

Description	Part Number
CTM-500 Battery	11220.9900

10. General Troubleshooting Operation

All LEDs remain off when the device is connected to power	• Check power supply, check ON/OFF switch
PWR LED flashing	• The device is in standby mode • Ensure the standby signal is connected to a supply greater than 7 VDC. • Ensure the supply voltage is greater than 7 VDC. • Device configuration has put the device into standby mode based on low ignition state detected by device
PWR LED ON all other LED OFF	• Device is powering on
SIM1/2 LED flashing	• SIM card is not detected, check that SIM(s) is inserted properly
GNSS/GPS LED flashing	• No valid GPS fixes. The GPS antenna requires a clear view of the sky to obtain a valid GPS fix. The time to fix can vary from a few seconds to 2-3 minutes depending on conditions. • GPS LED flashing has no impact on cellular connectivity. • Verify GPS antenna is physically connected to the CTM-500
Connection/Cellular LED OFF	• RF signal may not be available; Device is in an area of no cellular signal. • Cellular device is not registered on the network; make sure radio module/device/SIM has been activated on the network. • Device configuration has disabled Cellular connectivity or configuration is incorrect. • Verify Cellular antennas are physically connected to the CTM-500
Connection/Cellular LED (flashing RED)	• CTM-500 is registered on the network and is in an area of 5G/LTE coverage, but device has not obtained an IP address
No internet access after connecting to CTM-500	• Verify packet forwarding is enabled in the configuration of the modem

Resetting a CTM-500

Button Press Duration (s)	Behaviour once button is released	LED indicator when timer reached	Visual representation
Less than 5 seconds More than 20 seconds	Nothing	All LED(s) turn OFF except power	
5 to 10 seconds	Reboot device	SIM2 ON	
10 to 15 seconds	Revert to failsafe config and reboot	SIM1, SIM2, CELL top LED ON	
15 to 20 seconds	Revert to factory config and reboot	TECH, SIM1, SIM2, CELL top and middle LED ON	

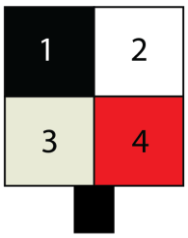
	It is important to note that the LEDs on the lefthand side will act as a counter while the Reset button is held. Each light represents one second and will loop back to the beginning to continue past 5 seconds. 

Appendix 1: Power

Molex Micro-Fit 3.0™ connector #:

Part Number	Description
43025-0400	Receptacle housing
43030	Crimp Terminals 20-24 AWG

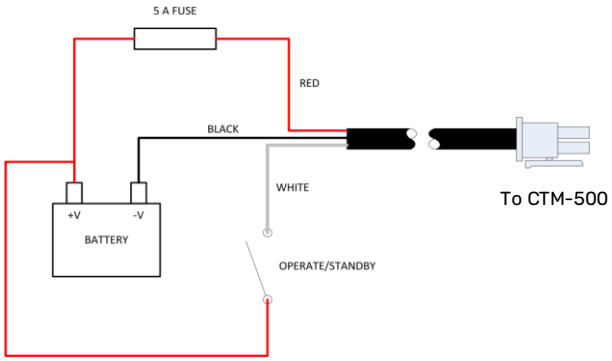
The CTM-500 can be connected with a DC power cable for direct connection to a DC power supply or with an optional AC Wall Plug adaptor that allows quick and easy connection to standard 120V AC Power.



1. Common Ground (GND)
2. Ignition (IGN)
3. Not Connected
4. DC Power (PWR)

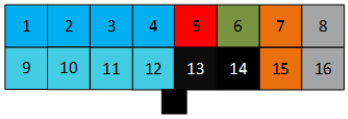
Red	+7V to +32V DC
Black	0V return (GND)
White	Standby / Ignition (+V for operation, off for standby)

A 5 Amp “slow-blow” fuse is recommended in the +V supply line.



Appendix 2: GPIO/RS232/1-Wire Data Cable Connection

A 16-position terminal is used for GPIO and Serial connections.



GPIO Block Pin	Signal	Name
1	INPUT1	Single Ended Input 1
2	INPUT2	Single Ended Input 2
3	INPUT3	Single Ended Input 3
4	INPUT4	Single Ended Input 4
5	VCC	Power (Power supply output – fused)
6	1-Wire Signal	1-Wire Signal
7	1-Wire LED -	Negative indicator for 1-Wire
8	RS232	Serial RxD (Receive)
9	DOUT1	Output 1
10	DOUT2	Output 2
11	DOUT3	Output 3
12	DOUT4	Output 4
13	GND	Common Ground for Power
14	GND	Common Ground for Power
15	1-Wire LED +	Positive indicator for 1-Wire
16	RS232	Serial TxD (Transmit)

General Purpose I/O (GPIO)

The GPIO connector is Micro-Fit 3.0™ 2 x 8 position 3.0 mm pitch connector manufactured by Molex.

Digital inputs have pull-down resistors. All general purpose I/O (GPIO) pins (i.e., all input and outputs) have transient protection.

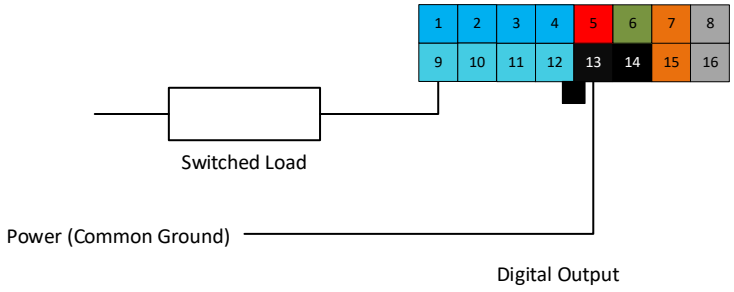
The I/O port provides for the control of 4 external devices and for monitoring 4 external inputs.

Appendix 3: GPIO Output Connection

The 4 outputs are configured as “open drain” which means that they can be directly connected to energize external relays, lamps, or other DC devices.

Maximum supply voltage is 36 volts, with a maximum load current of 500mA.

Recommended wire gauge for use with the connector is 20-24 AWG. Note that the OUT GND connection is connected to the CTM-500’s supply ground.



GPIO Input Connection

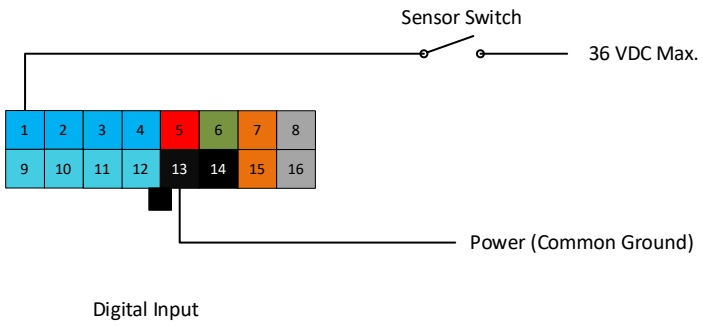
The 4 inputs may be configured in the CTM-500 for monitoring a digital DC voltage state or an analog DC voltage. All inputs are single ended.

For digital state monitoring the input voltage is 0-36 volts.

The threshold detection voltage is 2.5 volts with 1 volt of hysteresis. Note that the IN GND connection is referenced to the CTM-500’s supply ground.

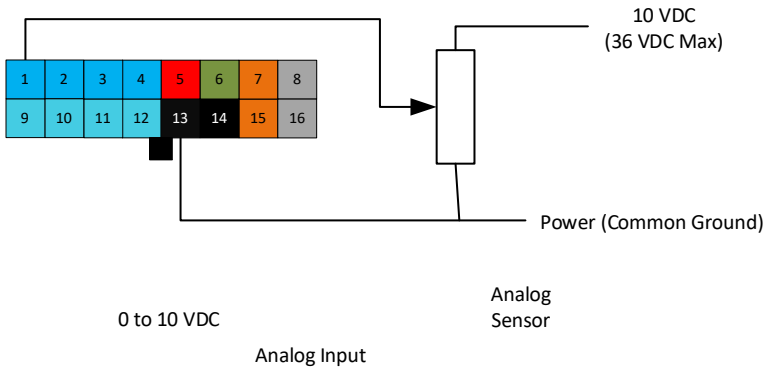
Analog input values will be sampled and can be reported at a maximum frequency of 10Hz.

Example of Digital Input wiring:



For analog voltage monitoring the measurement range is 0 to +10 volts with 10mV resolution. The input can withstand up to 36 volts. Note that the IN GND connection is referenced to the CTM-500's supply ground.

Example of single ended analog input wiring:



Technical Support

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