CTM-200 MANUAL (R2)

Model	Chameleon CTM-200 R2 (RELEASE 2)
Revision	Revision 1.2

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Revision Control

Description	Initials	Rev	Date
Initial Release	mm	1.0	16-April-2014
Updated Screenshots of new Web GUI	mm	1.1	24-April-2014
Updated more Screenshots of new Web GUI	sor	1.2	2-Feb-2016
Command Cleanup	js	1.2	11-Feb-2016

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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-200 wireless data device. 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-200 wireless data device.

1.1   Regulatory restrictions

CAUTION: Any modifications to the CTM-200 wireless data device 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-200 wireless data device contains a wireless device 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 20cm (8") must be maintained from all persons at all times and during all modes of operation. The antenna 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-200 devices are designed to operate with approved wireless modules installed. These cards will have their own FCC and Industry Canada approval ID numbers.

1.2   Electromagnetic Interference (EMI) – United States FCC Information

This equipment has been tested and found to comply with 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 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 antenna
- 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

1.3 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.

1.4 Trademarks

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

2 Physical Interfaces

2.1 Ethernet:

- Two Ethernet ports (bridged/non-bridged)
- Ethernet services can be disabled
- Ethernet ports can use DHCP or static IP addresses, DHCP can be configured to a single IP address.
- Gateway support when an Ethernet port is used to connect to the Internet through another router.
- Static NAT support
- Multiwan support for special packet routing configurations

2.2 General Purpose Input and Outputs

- One General Purpose 18 position Input and Output interface
- Inputs x 6 (2 differential)
- Outputs x 4
- Wiegand/Ibutton™ interface

2.3 RS-232 serial port

- Console, Command Line Interface access
- PPP, dial up over serial (legacy)
- PAD host interface (2 available), Virtual Serial Line replacement
- MODBUS host interface, MODBUS interface
- Serial Access Control (RFID) interface, Access control hardware interface
- Various Spreader Controller models, Spreader controller interface
- External GPS receiver, Add a high precision GPS receiver input
- Garmin™ Personal Navigation Devices, Interface for in vehicle display
- Auxiliary Equipment Interface
- Inputs x 2
- Outputs x 2

2.4   USB OTG (On-The-Go) port

2.5   CAN Bus port

- OBDII (ISO15765 -4)
- J1939

2.6   Locking 3 Wire power connector with ignition sense

- 6-36 VDC with Transient (spike) protection
- 2 mA @ 12 Volts low power mode

2.7   Multiple RF connectors (SMA/RP-SMA)

- Threaded SMA style for all RF connections

GPIO

USB on the GO Micro USB Type AB	
LAN 1 192.168.2.1	
LAN 0 192.168.1.1	
Secondary Serial port/RS485 (optional)	
Primary Serial Port RS232	

1. Output 1
2. Output 2
3. Output 3
4. Output 4
5. Common Ground for power
6. Power (Power supply output – fused)
7. Differential input 1 positive
8. Differential input 2 positive
9. Differential input 1 negative
10. Differential input 2 negative
11. Single ended input 3
12. Single ended input 4
13. Single ended input 5
14. Single ended input 6
15. Wiegand/Ibutton Interface
16. Wiegand/Ibutton Interface
17. Wiegand/Ibutton Interface
18. Wiegand/Ibutton Interface

3 SIM Card Installation

In most cases the device will ship with a pre-configured, installed SIM card. In this case SIM card installation is not required.

SIM card access is via the removal of the top cover plate by removing the 4 top cover #8 socket head cap screws using a 9/64" Allen key driver.

4 Connecting the CTM-200.

4.1   Connect Power

The CTM can be paired 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.

Red	+5.5V to +36V 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.
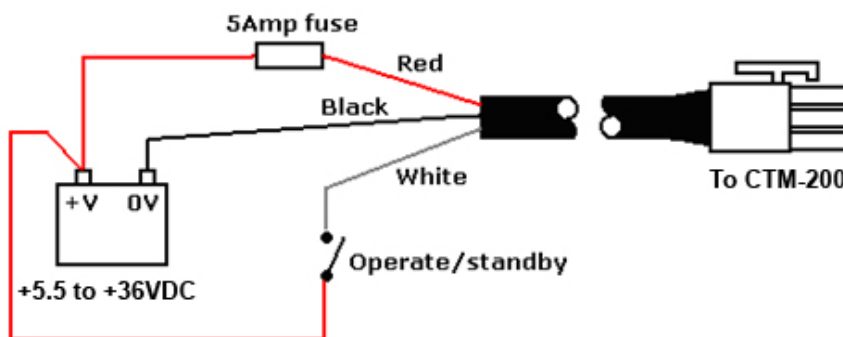
When the operate/standby line is used, the CTM-200 can take advantage of the state of this line using its "ignition sense" features. When the ignition line is wired the CTM-200 does not completely shutdown, a very small amount of power is used (2 mA) which allows a small microprocessor to monitor the status of various inputs so the device can "wake on events" that occur when the device is in low power mode.

Advantages of connecting power using the vehicle operate/standby or ignition line:

- Ignition ON/OFF events can be reported and logged.
- Shutdown based on a timer can be activated, for example, turn CTM-200 off 10 mins after ignition has been switched off.
- GPS re-acquisition time is minimized

Events that can trigger the device to enter full operating mode:
- Wake on an acceleration condition
- Wake on an onboard geo-fence violation.
- Wake on real time clock conditions.
- Wake up when a GPS monitored speed is met.
- Wake up based on a temperature (as monitored by the internal temperature sensor)
- Wake the CTM-200 an input being triggered via the GPIO interface.
- Wake on Man-Down Pendant alert

Before any external cables are connected (GPS, Cellular RF, WiFi RF, WPAN RF, serial, Ethernet, GPIO, CAN), verify that the power cable is wired correctly on the battery side. In certain cases, reversely connected battery input may cause damage which is not covered under warranty.

4.2   Connect External Antennas

The CTM-200 is designed to operate with external antennas. Antennas vary a great deal and should be selected based on the application the device is going to be used. All antenna connectors utilize SMA jacks with the exception of Wi-Fi/ Bluetooth which require reverse polarity SMA (RP-SMA)

For optimum performance antennas should be mounted in a vertical orientation as high up as possible and with clear line of sight in all directions. For regulatory purposes it must be mounted in such a position as to maintain a separation distance from any person of at least 20cm (8").

4.2.1 Cellular

The cellular connection supports MIMO (multi-in multi-out). For best performance ensure both primary and secondary cellular antenna connections are made to an antenna that supports diversity or to two separate antennas. If only one antenna connection is available, use the connection labelled "PRI-RF".

Technology	Frequency Range (MHz)
LTE	700(B17), (B13) / 1700/2100(B4) AWS, 2500(B41)
	Note: LTE frequencies are RF module dependent and can change based on carrier/region
WCDMA	850/1900/2100
CDMA	1xRTT/EV-DO 800/1900
GSM/GPRS/EDGE	850/900/1800/1900

4.2.2 GPS

The GPS antenna should be an active type antenna with a gain of at least 26dB and compatible with a 3.3 volt DC supply provided directly by the CTM-200 via the coax cable. The antenna installation should typically be on an upper horizontal surface of a vehicle or building with a clear 360 degree view of the sky.

Connect a suitable GPS antenna to the port labelled "GPS". For best performance select a GPS antenna that supports GPS/Glonass/Galileo(GNSS) constellations.

Technology	Frequency Range (MHz)
GPS/GLONASS/Galileo	L1 Band 1559-1610

4.2.3 Wi-Fi/Bluetooth

Local Wireless via Wi-Fi (802.11bgn) and Bluetooth (802.15.1) requires an external Wi-Fi antenna connected via a reverse polarity SMA connector

Technology	Frequency Range (MHz)
Wi-Fi	2400
Bluetooth	2400

4.2.4 Satellite (Optional)

Iridium satellite module support.

Technology	Frequency Range (MHz)
Wi-Fi	2400
Bluetooth	2400

4.2.5 Short Range Wireless or WPAN (Optional)

Short-range wireless for "Man-Down Pendant" accessories using the 802.15.4 standard

Technology	Frequency Range (MHz)
WPAN	2400

5 Installing the CTM-200

5.1   Mounting Orientation

The CTM-200 has an on board accelerometer that can be used to monitor device acceleration/deceleration (typically used to monitor y aggressive braking, acceleration and turning). The CTM-200 can be mounted in any position for acceleration/deceleration detection.
For the accelerometer to function properly the CTM must be securely mounted within the vehicle and calibrated or mounted in one of 24 orientations.

Calibration only occurs when the unit is installed or if the unit is repositioned within the vehicle.

There are two configuration options for accelerometer calibration.
   • Auto calibration
   • Pre-defined orientation

With "auto calibration" enabled the CTM-200 can be mounted in any orientation. The device will auto calibrate when the vehicle begins moving.

With "pre-defined orientation" enabled the CTM-200 must be mounted in one of 24 pre-defined orientations. No calibration is required.

Note: For auto calibration to function the CTM-200 must have a valid GPS signal.

5.2   Mounting

The CTM-200 includes a flexible mounting bracket that has eight 5mm mounting holes suitable for #10 screws , use 4 of the 8 available mounting holes. Take care not to over-tighten these screws and damage the bracket. Once this has been installed in the required location, clip the CTM-200 into the 4 tabs of the bracket. The bracket can be used as drill guide template. There are a total of 8 mounting holes (2, 4 hole patterns, 2" x 5.5" and 1.75" x 3.75").
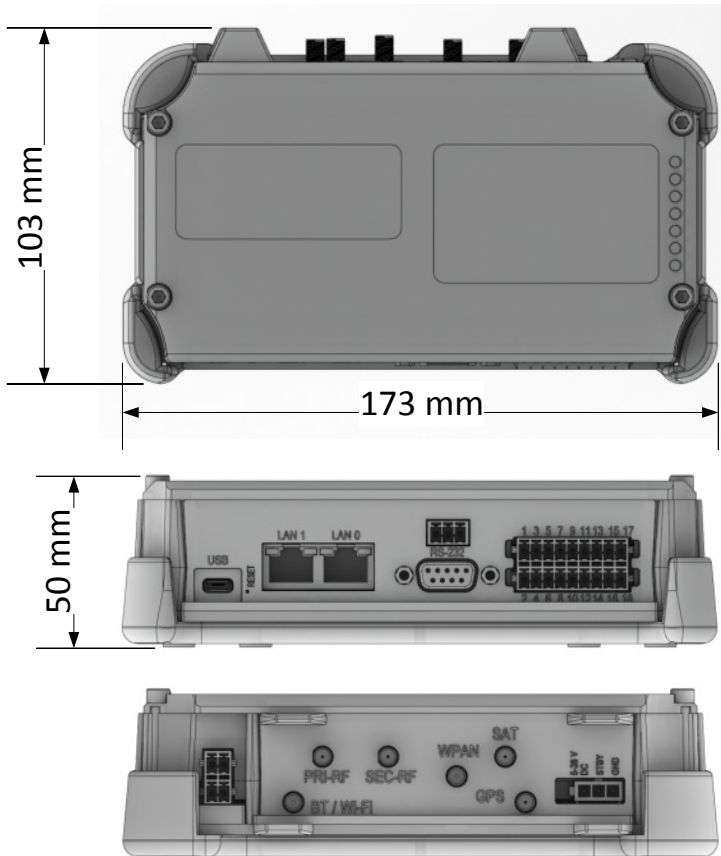
The CTM-200 should be mounted in an area where it is free from dust and liquids.
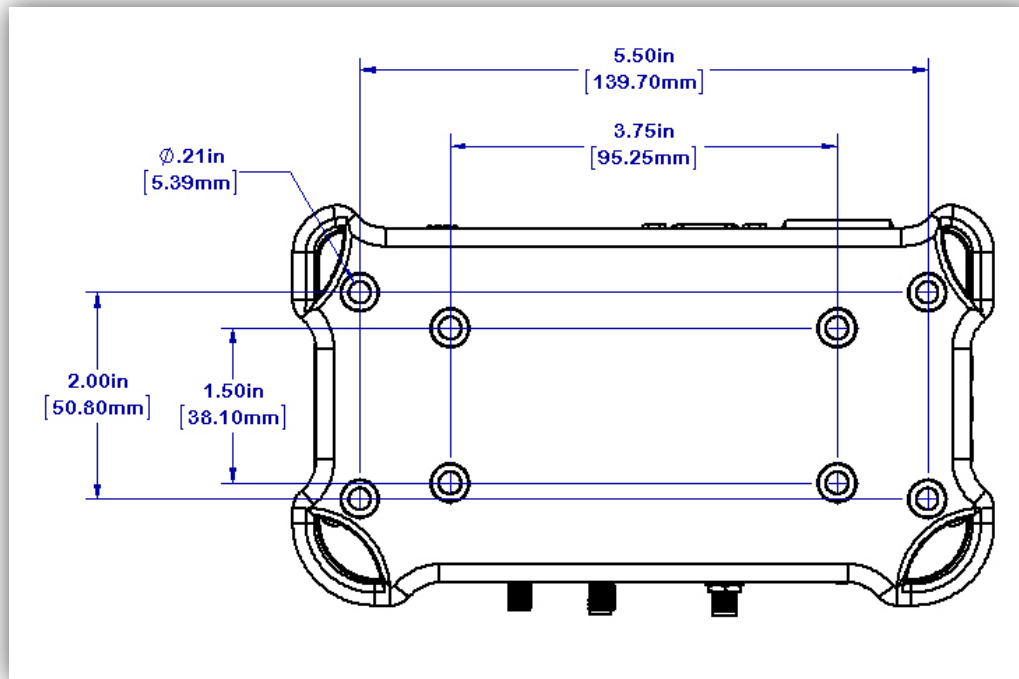
5.3   Connecting the Ethernet Cables

Plug one end of a standard Ethernet patch cable into the CTM-200's Ethernet port(s), and the other end into the LAN device, PC or Ethernet peripheral. The Ethernet port is compatible with 10Base-T or 100Base-T connection types. The Ethernet ports on the CTM-200 are non-switched, each having their own unique IP address. The Ethernet ports support auto MDI/MDIX, meaning no Ethernet crossover cable will be needed regardless whether the CTM-200 is connected to a router or to a computer.

Ethernet Port	Default IP
LAN0	192.168.1.1
LAN1	192.168.2.1

5.4   Serial Data Cable Connection

The serial data port is a standard DB9 female connector configured as Data Communication Equipment (DCE) and is wired as per the table below.

DB9 Pin	Signal	Name	Direction
1	DOUT5	Digital Output 5	
2	**RxD**	**Received Data (by DTE)**	**CTM-200 to PC**
3	**TxD**	**Transmitted Data (by DTE)**	**PC to CTM-200**
4	INPUT7	Input 7	
5	**GND**	**Signal Ground**	
6	DOUT6	Digital Output 6	
7	**RTS**	**Request To Send**	**PC to CTM-200**
8	**CTS**	**Clear To Send**	**CTM-200 to PC**
9	INPUT8	Input 8	

Serial data ports on most computer equipment are configured as Data Terminal Equipment (DTE) with a DB9 male connector. A standard serial data cable will allow for direct connection of the CTM-200 to most computer and terminal equipment. In some cases it may be necessary to insert a "null modem" or "gender changer" in the serial data line in order to correctly connect between the devices.

As an option on the CTM-200 a second serial port is available as a 3 pin DCE connection:

PIN1:   RxD
PIN2:   TxD
PIN3:   GND

5.5   General Purpose I/O (GPIO)

The GPIO connector is a 2 x 9 position 3.5 mm pitch connector. Single or double row connectors can be used.

In addition to the 4 outputs and 6 inputs on the GPIO connector an extra 2 outputs and 2 single ended inputs are available on the RS-232 port.

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

Phoenix Combicon connector #:

| Part Number	Description	Locking Tab
1952092	Single Row	YES
1952335	Single Row	NO
1738872	Dual Row	NO
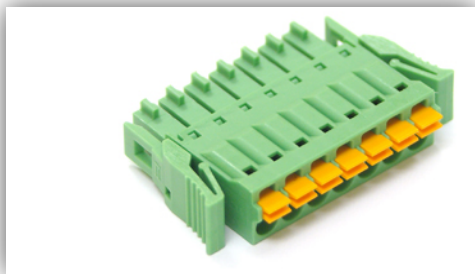
The I/O port provides for the control of 4 external devices and for monitoring 6 external sensors and interfacing to RFID systems.

GPIO Block Pin	Signal	Name
1	DOUT1	Output 1
2	DOUT2	Output 2
3	DOUT3	Output 3
4	DOUT4	Output 4
5	GND	Common Ground for power
6	VCC	Power (Power supply output – fused)
7	INPUT1+	Differential input 1 positive
8	INPUT2+	Differential input 2 positive
9	INPUT1-	Differential input 1 negative
10	INPUT2-	Differential input 2 negative
11	INPUT3	Single ended input 3
12	INPUT4	Single ended input 4
13	INPUT5	Single ended input 5
14	INPUT6	Single ended input 6
15 – 18	RFID	Wiegand/iButton™ Interface

Additional GPIO pins available on the DB9 serial port connector:

| DB9 Pin	Signal	Name
1	DOUT5	Output 5
4	INPUT7	Single ended input 7
6	DOUT6	Output 6
9	INPUT8	Single ended input 8
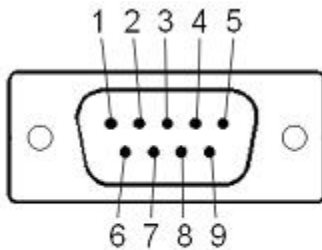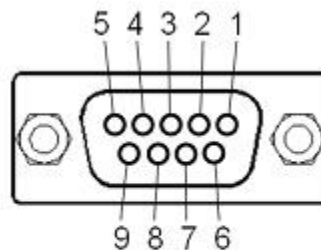
Male DB-9   Female DB-9

5.5.1 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 16AWG. Note that the OUT GND connection is connected to the CTM-200's supply ground.
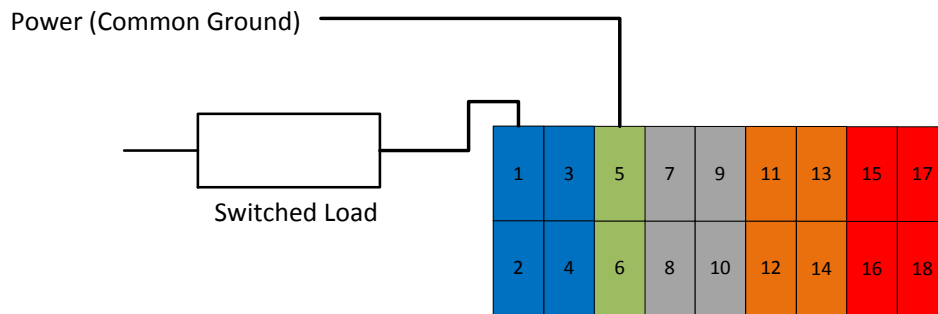
5.5.2 Input Connection

The 8 inputs may be configured in the CTM-200 for monitoring a digital DC voltage state or an analog DC voltage. Six of the inputs are single ended and two are differential.

For digital state monitoring the minimum input voltage is 0 volts while the maximum is 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-200's supply ground.

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

Example of Digital Input wiring:
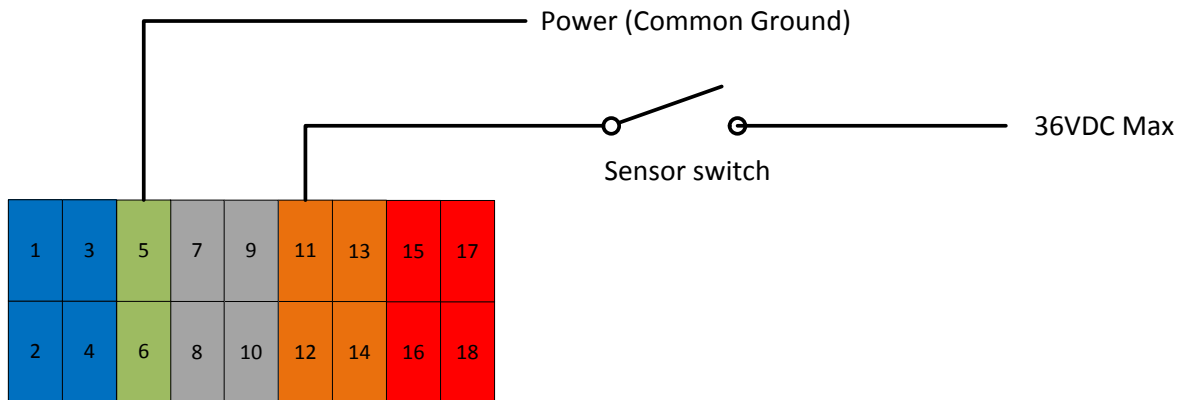
For analog voltage monitoring the measurement range is 0 to +10 volts with 10mV resolution. The input can withstand up to 36 volts. Note that the IN GND connection is referenced to the CTM-200's supply ground.

Example of single ended analog input wiring:

Example of Differential analog input wiring
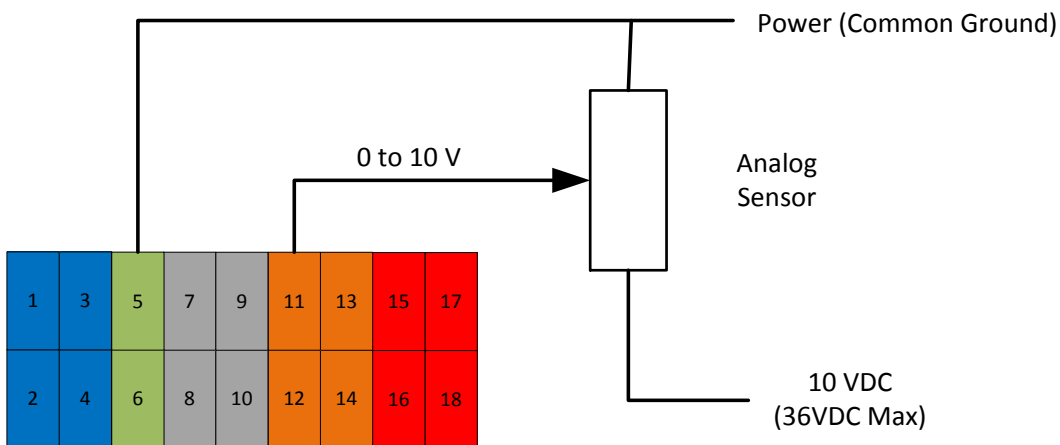

1	3	5	7	9	11	13	15	17
2	4	6	8	10	12	14	16	18
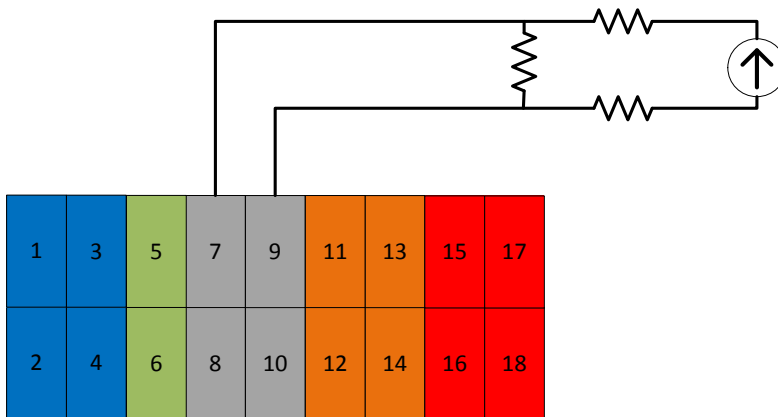
5.6   CAN2.0B Bus

The CAN interface is used primarily to interface to Vehicle sub-systems that support CAN communications. This includes all small and light duty vehicles manufactured in 2008 and later (ISO15765-4) and heavy duty vehicles that support J1939.

An accessory CAN cable + OBDII or J1939 "Y Cable" is required to interface to a vehicle Engine Control Unit (ECU)

OBDII or J1939 Y-Cable:

cypress solutions

Accessory CAN cable:

Plug Part Numbers:

Phoenix Combicon connector #:   **1952021** (with locking tab)
                                 1953402 (without locking tab)

PIN1:   CAN High Node
PIN2:   Common Ground- Optional
PIN3:   CAN Low Node
PIN4:   Chassis Ground-Optional

6   Configuring the CTM-200

The CTM-200 will be ready for access and configuration 30-40 seconds after applying power.

A CTM-200 with factory default configuration provides 4 different ways of gaining access to its internal control interface. Once access has been obtained, the CTM-200 can then be configured either by command line or by using the built-in web interface:

Access Method:	Default Port Configuration	Your Device's Configuration
Ethernet Port 0 (LAN0)	192.168.1.1/24	192.168.1.2/24 or use DHCP
Ethernet Port 1 (LAN1)	192.168.2.1/24	192.168.2.2/24 or use DHCP
Wi-Fi	192.168.1.1/24 (bridged to LAN0)	192.168.1.2/24 or use DHCP
Serial port	RS232 DCE, 115200 8N1	RS232 DTE, 115200 8N1

Note: Serial connections require a terminal program such as 'COM 7.5', 'PuTTy' or 'minicom'.

The following paragraphs describe how to use the CTM-200's built-in web interface to configure the CTM-200. However, the web interface only provides a small subset of all available configuration options. To fully utilize the CTM-200's advanced options; it is required to use the command line interface. The full range of commands is beyond the scope of this document; however the most important ones will be presented here.

6.1   Login

To configure the CTM-200, the user must first login to the CTM-200 either via the WebGUI or terminal session. Both login methods use the same username and password.

Login	Default value
Username	admin **or** root
Password	Chameleon
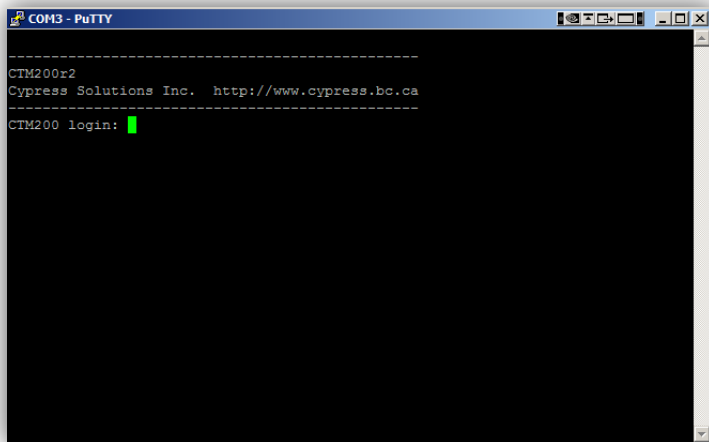
Setting the Telnet, SSH or Web GUI password is controlled using the `cmd telnetpswd` command

6.2   Web Interface

After logging in, the CTM-200 will show an overview screen with the most important device and network statistics, as well as links to configuration pages and documentation. The Web GUI is designed with a menu on the left and a series of "Tiles" that reflect the features of the product. As you resize your browser window the tiles will automatically move to match your browser size.

The Web GUI can easily be displayed on tablets and mobile devices that support web browsing, tiles will automatically resize to the browser window size.
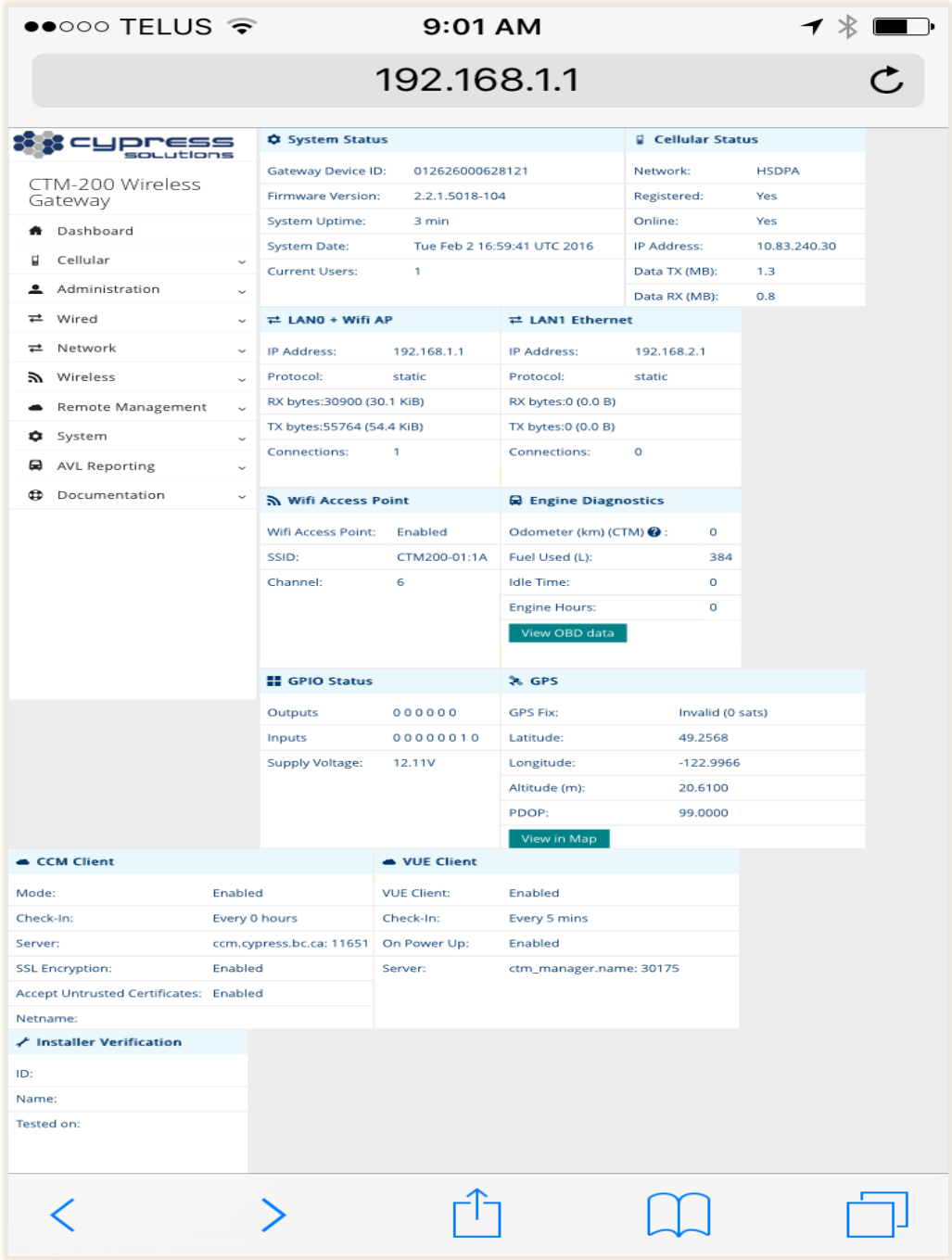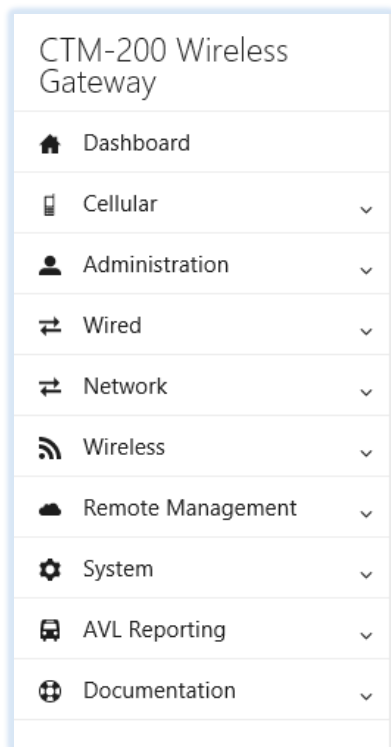
Name	Description
Dashboard	Returns you to home screen from any nested Tile view
Cellular	View Connection Status and configure Cellular Settings
Admin	Setup User Authentication and Access Control
Wired	Display Network Status, setup LAN and Serial Port
Network	Configure Port Forwarding and Static Routes
Wireless	Configure WIFI, Captive Portal, and Bluetooth
Remote MGMT	Configure Dynamic DNS, SNMP, and VUE Remote Management
System	Upload Firmware, view System Logging, enter Command Line, and Show Configuration
AVL Reporting	Setup Time Based, Distance and Speed, and Time, Distance, Heading reports
Documents	View User Manual, Alphabetical & Categorical Command Reference, Report Messages, and OBD2-J1939 Reference

CTM-200 Wireless Gateway

- 🏠 Dashboard
- 📱 Cellular ⌄
- 👤 Administration ⌄
- ⇄ Wired ⌄
- ⇄ Network ⌄
- 📶 Wireless ⌄
- ☁ Remote Management ⌄
- ⚙ System ⌄
- 🚌 AVL Reporting ⌄
- 🌐 Documentation ⌄

Any changes that are made on the Web Interface the user will be prompted with a "Save Configuration" button. The "Save Configuration" will remain persistent as you navigate from one Tile to the next, requiring you only to save the configuration after all changes are complete.

To apply the configuration press the "Restart Device" button on the left menu.

Attention
Configuration has changed, click to save configuration.

Save Configuration
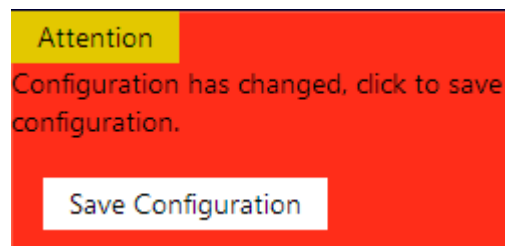
6.3   Command Line Interface

Command line interface offers quick command entry but requires knowledge of the command structure.   The above section that describes the Web GUI offers a user-friendly interface, and allows easy configuration of standard device features and simple AVL reports but is limited in scope.

There are approximately 400+ CTM specific commands. All CTM commands are prefixed with "cmd". The CTM-200 is running a linux™ operating system based on the 3.2 Linux kernel.

Command line configuration is accomplished by following the steps:

- Input the appropriate command(s) *"cmd …………"*
- After entering commands issue a save command   *"cmd save"*
- Reboot by physically removing power or entering the command *"cmd pwr mode 2"*

The Documentation tab of the Web GUI shows the command reference guide. These commands can be entered in the "Enter command:" box or they can be entered in separate console session using tools like "Putty" terminal emulator.

```
------------------------------------------------
CTM200r2
Cypress Solutions Inc.   http://www.cypress.bc.ca
------------------------------------------------
CTM200 login: admin
Password:
Last login: Wed Dec 11 10:38:41 -0800 2013 on /dev/pts/0.
root@CTM200:/#
```

In addition to the CTM configuration commands, the CTM-200 provides common GNU/Linux shell and file utilities accessible through console, telnet or SSH sessions. Shell scripts can be used for custom control and management, and can be integrated with the CTM-200 to enable triggering of scripts on device-generated events. The system supports both a FTP server and client, an SSH/SCP server, and a HTTP webserver

6.4   Configuring, Cellular Wireless Network Parameters

Cellular configuration is accessed by the "Cellular" select button on the left of the Web GUI

For most devices, the following information is required:

- An activated SIM card needs to be installed in the CTM-200.
- The correct installed module must be selected
- The mobile APN or Access Point Name.
- In almost all cases, 'Username' and 'Password' can be left empty

Contact Cypress Solutions if the module you are trying to install is not shown in the drop down list on the Web interface.

Enter the APN and select the embedded module name from the "Module" drop down list.

Press the "OK" button, "Save Configuration" to reboot the CTM-200.
After the device powers on the CTM-200 will have an IP address as shown in the "status" window.

🖳 **Cellular Status**	
Network:	LTE
Registered:	Yes
Online:	Yes
IP Address:	72.142.160.244
Data TX (MB):	5.1
Data RX (MB):	8.7

If the IP address displayed is 0.0.0.0 or the online state is "NO" then the CTM-200 was unable to negotiate a wireless connection. Check that the APN was entered correctly and the account is active.

The CTM-200 is designed to operate as an "always on, always connected" device. After successful configuration the CTM-200 will attempt to maintain a network connection at all times. If the connection is lost due to out of coverage or other reasons, the CTM-200 has internal logic to attempt to quickly reconnect to the network. During loss of cellular connectivity report data destined for Fleet tracking servers is stored in non-volatile memory. This data will be automatically forwarded when network connectivity is re-established.

Note: If the cellular device is incorrectly configured the CTM-200 will automatically power cycle approximately every 4 minutes until it is configured for the correctly installed module.

6.5   Wi-Fi Networks

Wi-Fi configuration is accessed by the "Wi-Fi Access Point" or "Wi-Fi Client" select button on the left of the Web GUI

Wi-Fi support is based on 2.4 Ghz IEEE 802.11 b/g/n technology.   Access Point and Client configurations are supported with standard features such as SSID, Channel, WEP/WPA/WPA2/PSK/PSK2/TKIP Encryption, key and RADIUS server support. EAP PEAP/TTLS and RADIUS authentication is also supported.
If Wi-Fi is configured as an Access Point the wireless connection is available by default at **192.168.1.1**.

The Wi-Fi can be un-bridged from LAN0 interface if you wish to have the WLAN on its own subnet, for example, **192.168.0.1/24**

Default Wi-Fi configuration is to have the Wi-Fi configured as an access point. Default SSID is **CTM200-XX:XX** where **XX:XX** are the last 4 digits of the CTM-200 mac address, for example: CTM200-02:9B and the default password is CypressAccess**.**

There are two modes of operation for Wi-Fi, Access Point or AP provides connectivity to connected devices. Client mode uses another AP to provide connectivity for the CTM-200:

6.5.1 Access Point

CTM-200 serves as an internet access point to other Wi-Fi enabled devices, up to 7 devices can be connected to the CTM-200 Wi-Fi access point at any one time.

6.5.2 Client

CTM-200 can take advantages of existing Wi-Fi networks for data communications. Client configuration can co-exist with cellular data connections or the device can function as a Wi-Fi client with no cellular module installed. The CTM-200 has internal logic to manage the "priority" of the connection so in the cases where two wireless networks are available, cellular and Wi-Fi.

7 Additional Features

7.1 Automatic Power Control

The CTM-200 supports supply voltages ranging between 5.5 VDC and 36 VDC. At **default settings** power supply voltage must be a minimum of 9VDC for the CTM-200 to operate.

Note: In some vehicle operation, when starting the engine the vehicle supply voltage will dip below 9VDC momentarily. The CTM-200 can handle power dips below 9VDC down to 6VDC. If continual operation is required below 9.0 V, the CTM-200 needs to be configured using the "`cmd pwr vcct`" command.
The Chameleon CTM-200 gateway has three power modes:

Mode	Current @ 12V	Description	Mode change event
Operation	300 mA	In this mode the device is fully powered up and ready to receive or make network connections	The device will go back into shutdown/standby mode when the ignition/standby signal is deactivated or upon expiry of the power ON timer if configured.
Shutdown	< 2mA	Only the CTM-200's power management circuits are operating.	The device will go back into operation mode when the ignition/standby signal is activated, wake on event occurs (e.g. input, temperature, motion), or upon expiry of the power OFF timer as configured.

The CTM-200 can be configured to remain on for a defined period after the standby/ignition signal has been turned off. This enables the gateway to continue sending position reports or be used for data operations even after the vehicle ignition has been switched off – e.g. for short duration driver breaks.

When in its power shutdown mode the gateway may be configured to resume full operation by monitoring events such as:

- Acceleration
- GPS location (on board Geo-Fence)
- Time
- Speed
- Temperature
- Voltage
- Input events
- Man Down Pendant alarms

7.2   Power Consumption

The power consumption of the CTM-200 gateway will depend on its supply voltage, its current operating function and its RF environment.

The following table is provided to assist application integrators in defining the power requirements for their specific application.

Power Consumption	Weak RF signal(12V)	Strong RF signal(12V)	Weak RF signal(24V)	Strong RF signal(24V)
Shutdown Mode	2 mA typical	2 mA typical	3 mA typical	3 mA typical
Downloading (Receive data)	450mA max	350mA max	220mA max	195mA max
Uploading (Transmit data)	500mA max	390mA max	260mA max	210mA max

7.3   Device Reset

The CTM-200 gateway may be manually reset via the front panel using a <1mm diameter (0.04") wire tool (a standard paper clip). This can be used to cause the gateway to reset its operation, to reset the LAN IP settings, or to reset the gateway's configuration to the factory shipped configuration.

Power reset: Press and hold for **1 to 3 seconds**

LAN IP reset: Press and hold for **3 to 10 seconds**
- The PWR LED will turn off at the 3-second mark and start flashing slowly once the button is released. It keeps flashing until the LAN IP reset is complete.
- LAN IP addresses will be reset as follows:
    o   LAN0 Ethernet port: 192.168.1.1
    o   LAN1 Ethernet port: 192.168.2.1

Shipped configuration reset: Press and hold for **10 or more seconds**

- The PWR LED will turn off at the 3-second mark and start flashing rapidly at the 10-second mark. It keeps flashing until the configuration reset is complete.   The CTM-200 will be restored to the configuration that was loaded on the unit at the time of shipping to the customer.

Reset Type	Hold Duration (sec)
Power Reset	>1 to <3
LAN IP Reset	3 to <10
Shipped Configuration Reset	10+

7.4   LED Indicators

There are seven LED indicators on the CTM-200 top. These are used to show the status and operation of the device.

For wireless data devices that provide network diagnostic information:

LED	Description	Solid	Blinking	Off
Wi-Fi 🔴	Wi-Fi status	CTM-200 serving as an Access Point or connected as a Client	CTM-200 configured as a Client but not connected	Wi-Fi not enabled
BLUETOOTH 🔵	Bluetooth status	Connected with another Bluetooth device	Bluetooth enabled but not paired	Bluetooth not enabled
MODE 🟠	Indicates the type of wireless data connection	3G Connection (EV-DO/HSPA)	4G Connection (LTE)	No cellular registration or 2G only or not available due to RF module limitations
GPS 🟢	Status of the GPS module or external GPS device	GPS module or external GPS device has a valid position fix	GPS module or external GPS device does not have a valid position fix	
IP/DATA 🟢	Data is being transmitted or received	Solid on if CTM-200 has an IP address on the wireless network	Flashing intermittently if data packets are sent/received via the wireless network	No data being transmitted, not connected to the wireless network
RF 🟢	Status of the device on the wireless network	Very good signal > 75% signal quality	Slow blink 0-35% quality Med. blink 35-55% quality Fast blink 55-75% quality	Device is not detecting a valid RF signal or is not registering on the wireless network
PWR 🟢	Power status of the device	Full operating mode and able to connect	Device is in standby mode	Device has no power

8 General Troubleshooting Operation

All LEDs remain off when the device is powered	• No power is being applied to the CTM-200 • Check power supply make sure min. 9 VDC is being supplied
PWR LED flashing	• The device is in standby mode • Ensure the standby signal is connected to greater than 9VDC • Ensure the supply voltage is greater than 9VDC. • Remember that the device is designed to go into standby mode if the standby signal is off after a configured time period (e.g. 10 seconds by default)
PWR LED ON all other LED OFF	• Device is booting Linux
Device is constantly rebooting every 4 minutes with no user input. Only PWR LED and GPS LED (solid or flashing) are on.	• Incorrect cellular device is configured. The CTM-200 is configured by default to auto connect to a cellular network. If the CTM-200 determines that communication with the internal cellular radio module or device is not working, it will attempt to reset the communication port; this will result in continual system reboots if incorrect module/device is selected.
GPS LED flashing	• No valid GPS fix. 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 several minutes depending on conditions. • GPS LED flashing has no impact on cellular connectivity.
RF LED OFF MODE LED OFF IP/DATA LED OFF	• RF signal may not be available; CTM-200 is located in an area of no cellular activity. • Cellular device is not registered on the network; make sure radio module/device/SIM has been activated on the network. • Incorrect configuration of internal radio module, ensure correct device has been configured
IP/DATA LED OFF RF LED (solid or flashing) MODE LED (solid or flashing)	• CTM-200 is registered on the network and is in an area of 3G or 4G coverage but device has not obtained an IP address • `cmd ipadr` will return 0.0.0.0
MODE LED OFF All other LED's ON (solid or flashing)	• CTM-200 is in an area where no 3G or 4G connection is available (2G only) • Cellular module/device does not support diagnostics so MODE LED is disabled. Device may still perform at 3G or 4G levels

9 Time

The CTM-200 has an onboard real time clock. The real time clock is used to provide timestamp information for system generated events and reports. The real time clock is capable of keeping system time with all power removed from the CTM-200 between 30 and 40 hours at room temperature.

9.1 Time Synchronization

The real time clock (RTC) will synchronize with external sources. External time sources are time from GPS satellites, Time from the Cellular network and time from an NTP server.

Available features:

- Set the period for time synchronization to external sources
- GPS, NTP server or cellular network can be used as a time synchronization source

9.2 Time zones

The default time zone is UTC, but is user configurable.

10 Device Management

In addition to the remote connection mechanisms such as Telnet/SSH and Web other mechanisms are available for managing the remotely deployed CTM-200.

10.1 Upgrading and Configuring

The CTM-200 firmware can be upgraded locally or remotely over the wireless connection. Firmware images ".tar" files can be downloaded from the Cypress Solutions repository or hosted on customer supplied repositories or locally on computer on a local network. In most cases it is not necessary to upgrade firmware unless a specific feature or enhancement has been added. The firmware update process uses a redundant firmware image system. If for any reason the firmware upgrade fails, the previous firmware will load allowing the process to be repeated.

Notes:
- It is highly recommended to test all device configuration and operation before deploying devices to remote locations.
- Not all wireless networks offer "public" IP addresses that are remotely accessible; some are firewall protected to allow access from either the same IP pool only or restricted IP addresses. Contact your wireless network provider or administrator to determine what options are available.
  Some device management options can work with dynamic/non-routable IP addresses.

- Some networks will force device IP addresses to change at regular intervals. Without proper configuration, this could cause a remote device to become inaccessible if the device IP address is not known. The CTM-200 can be configured to generate a report when the IP address of the device changes.
- Incorrectly configuring the device could cause the device to become inaccessible, use caution when issuing commands via any remote mechanism.

10.2 How to access the CTM-200 remotely

There are multiple ways to access and configure a CTM-200 remotely:
- **SMS** (allows commands to be sent to the CTM-200 via SMS; this command only applies to devices that support SMS, contact Cypress Solutions for more details
- **SNMP** Simple Network Management protocol support
- **Telnet** and **SSH** (secure shell) (access to command line interface (CLI))
- **Device Embedded Web Page** (access to web page/browser based configuration)
- **ULCP** (allows configuration of digital outputs only using ULCP binary format)
- **CTM Manager** device management software available from Cypress Solutions.

10.3 SMS

Note: SMS support is dependent on the embedded radio module, carrier and account options; please contact Cypress Solutions if you have questions regarding SMS functionality

There are two types of SMS commands that the CTM-200 gateway accepts: (1) **$0cmd** - command that does not require the response to be sent back to the sender and (2) **$1cmd** - command that does require the response to be sent back to the sender. Both commands can act as a remote management and configuration tool for CTM-200 gateways.

Any of the CTM-200 commands can be appended after $0/$1 except for the following commands, which are discarded by the SMS command processor:

> *cmd event dump*
> *cmd showconfig*
> *cmd factory*

No configuration of the CTM-200 is required for it to accept SMS commands

Message format:
$1<ctm command> if the command provides feedback.
$0<ctm command> if the command does not provide feedback.

The first two characters of the message should always be **$0 or $1**. Any of the CTM-200 commands can be appended after **$0 or $1** except for the commands discarded by the SMS command processor (See list above.). Moreover, multiple commands separated by **<CR>** or **<CR><LF>** can be sent in a single SMS message

Examples:

1. Return firmware version to SMS sender
   $1cmd ver

Returns: 5555551212:r2.0.5.2779-144

2. Issue command to power cycle only
   $0cmd pwr mode 2

Note: commands that output more than 166 characters will not generate feedback.

sendsms –P<PHONE #> -T<$0 or $1 ctm command>   sends ctm command to another CTM-200

SMS features:

- Define an SMS "friends list" whichlimits incoming SMS commands received to a specific set of phone numbers
- simple sms send of a text string from a CTM-200

10.4 SNMP

The CTM-200 supports the Simple Network management Protocol. The CTM-200 can act as an SNMP (Simple Network Management Protocol) agent to report device information to an SNMP manager. SNMP version 2 allows a user to retrieve CTM-200 information such as model, device ID, IMEI, RSSI, PAD IP, PAD port, GPS coordinates, WLAN and LAN MAC and IP addresses, etc.
The CTM-200 listens on UDP port 161 for SNMP requests.

For more details on SNMP support please contact support@cypress.bc.ca

10.5 CTM Manager

CTM Manager is a windows/linux application that offers device management. The CTM-200 can be configured to connect to CTM Manager server via a service that automatically executes at pre-defined schedules. Commands can be queued on CTM Manager server for the remote CTM-200. When the CTM-200 checks in, CTM Manager will deliver the payload to the CTM-200 for execution. CTM Manager does not require the IP address of the CTM-200 to be routable.

11 Reporting

Reports are generated by the CTM-200 and are linked to events or triggers. The CTM-200 uses an event-report-message based system to send data to AVL or fleet management servers. Reports consist of messages that provide information about the event or trigger. The most common and widely used report is a GPS report. A GPS report can be triggered by a number of conditions, for example, time, speed, distance, and heading. Reports are typically delivered via the wireless link (UDP or TCP), but they can also be delivered via Serial, Ethernet, and email, SMS or stored in files for file based reporting.

The type and a and nature of reports from the CTM-200 can be broken down into 3 main categories

- Regular Interval AVL (Automatic Vehicle Location)

- Irregular or event trigger based (Rapid deceleration or acceleration, tire blowout (, Man Down Alert

- Infrequent Interval (data that is not required in real time, fuel values, odometer values, engine hours, idle time)

11.1 Regular Interval Reports (AVL)

A regular interval report is normally an AVL (Automatic Vehicle Location) type report containing location (lat/long), heading, and speed.

AVL reports are triggered on a frequent basis to match the needs of the business unit. More frequent reports provides a more detailed path of the vehicle but consumes more data. Less frequent reports have less detail but consume less data.

The best compromise is a event trigger mechanism that utilizes, time, speed, distance and heading as logic to determine the best interval to send a report. For example, if a vehicle is stationary there is no need to send AVL reports every few seconds as the report is not changing

The CTM-200 Web GUI provides a quick mechanism for configuring a regular AVL Interval report.

Time Based Reports

Distance and Speed Reports

Time, Distance, Heading Reports

11.2 Irregular Interval Reports

An Irregular interval report is typically a report generated by a sensor or switch that triggers an event. The event is random in nature by that there may be no pattern as to when the event triggers, but there is a requirement from the business unit that identifies the event in real time to facilitate an action. Irregular reports can trigger as frequently as Regular reports but the trigger is not typically AVL based.

Examples of Irregular reports are:

- Acceleration
- Driver ID
- Engine parameters
- Auxiliary equipment such as Tire pressure Monitors, spreader controller data, weight systems

For example to send a "hard acceleration" event or "hard brake" event an "accelcond" would be set to define the "trigger" points. The CTM-200 monitors the acceleration in real time and when the condition is met a report is generated that sends the message, in this case a message containing relevant acceleration data

11.3 Infrequent Interval Reports

An Infrequent interval report is typically a report generated by an event that is infrequent. In many cases "ignition" is considered infrequent as there can be long periods between ignition events. The idea behind the Infrequent Interval report is that these reports typically contain information is useful but not required in a real time environment

Examples of Infrequent reports are:

* Odometer
* Fuel
* Idle
* Engine Hours
* Wireless Data consumed

An ignition condition "igncond" is typically used to trigger an infrequent report. The ignition condition triggers based on the state of the ignition, OFF/ON etc.

11.4 Triggers or event conditions

* Acceleration trigger condition
* Data event trigger
* Geo-route violation conditions
* GPS trigger condition (Speed, Distance travelled, heading change, time)
* Idle trigger condition
* Ignition trigger condition
* GPIO trigger condition
* MODBUS exception condition
* Engine diagnostics trigger condition
* Power up trigger condition
* Supply voltage trigger condition

Irregular and Infrequent reports are triggered by the below conditions, the GPS condition will typically trigger a regular AVL type report.

Triggers or events	Description	Event Label
GPS	8 available conditions can be triggered on time, speed (low speed, high speed), distance travelled, heading change.	GPSx
Input Condition	8 available conditions, time based, alarm based on input states of 6 inputs, up to 2 inputs can be compared in each condition. IP change trigger	GPIOx
Ignition	8 available conditions, triggers on ignition going off, on or transition.	IGNx
OBDII or J1939	8 available conditions. Time based, or based on a valid OBDII or J1939 parameter being =,>,< the reported value from the vehicle ECU	OBDx
Power Up	8 available conditions, triggers on the device being powered up.	PUPx
Voltage	8 available conditions, trigger when a supply voltage is below, above or a supply threshold is passed.	VCCx
Acceleration	8 available conditions, triggers when an acceleration, deceleration or lateral acceleration threshold has been met.	ACCELx
Geo Route	In Zone or Out of Zone trigger, or alarm triggers based on crossing of zone threshold.	GEOx
Idle	Trigger a report when an idle time is exceeded	IDLExSTART IDLExEND
Data	Triggers when a pre-configured threshold is exceeded.	DATAx
MODBUS	Trigger MODBUS or MODBUS exception reports	
Man Down	Triggers when Man-Down Accessory device generates an event (CTM-200 must be configured to listen for traffic and optional WPAN Gateway must be installed)	MANDOWNx
Boomtracker	Triggers when short range wireless asset tracker accessory comes within range of CTM-200 (CTM-200 must be configured to listen for traffic and optional WPAN Gateway must be installed).	BOOMx
Proximity Card/RFID/I-Button	Triggers when a compatible RFID device sends a message to the CTM-200 via external peripheral, RFID reader, etc. (uses modified message 114, $PGPS for payload)	RFIDx
External Equipment	Triggers when supported external equipment sends data to CTM-200 serial port. Typical External equipment include salt spreader, weigh systems, etc. (uses modified message 114, $PGPS for payload)	EXTz

11.5 Report Definition

A report definition consists of:

- Transport protocol (UDP, TCP, SMS, email, asynchronous, file based)
- Destination IP address
- Destination Port address
- Group of messages to deliver.

Each report definition is capable of delivering up to 4 messages per report. 8 unique report definitions each can be associated to GPS and GPIO conditions. All other event conditions can have up to 999 report definitions shared between the various report triggers or events.

An example of an "acceleration report" definition:

```
cmd accelcond 1 5 -30 0 5       #set the acceleration condition or trigger, in this case condition #1
cmd accelreport 1 99            # bind acceleration condition #1 to report definition #99
cmd reptype 99 0 3 1            #  use UDP protocol with SNF enabled
cmd repaddmes 99 114 136        # include a GPS with ID message(114) and acceleration message (136)
cmd repremip 99 65.61.200.71    # destination IP address
cmd repremport 99 8300          # destination Port number
```

11.6 Report Messages

 Messages are defined using a standard NMEA message format; some messages are available in a binary format.

ASCII	Description
$	Start character
ABC... or PABC	Message type. Messages starting with P are non-standard proprietary.
<string>,<string>	Message body. Multiple strings are separated with commas.
*	Message terminator
hh	Message checksum
<CR><LF>	Carriage return, line feed

Standard NMEA Sentences

Decimal ID	Message Name	Message description
127	$GLGSV	GLONASS NMEA GSV message-$GLGSV
80	$GPGGA	GPS NMEA GGA Fix Data message- $GPGGA
16	$GPGLL	GPS NMEA GLL Geographic position, latitude / longitude message- $GPGLL
84	$GPGSA	GPS NMEA GSA GPS DOP and active satellites message- $GPGSA
118	$GPGSV	GPS NMEA GSV GPS Satellites in view message-$GPGSV
82	$GPRMC	GPS NMEA RMC Recommended minimum specific GPS/Transit data message-$GPRMC
83	$GPVTG	GPS NMEA VTG Track made good and ground speed message- $GPVTG
128	$QZGSV	QZSS NMEA GSV message-$QZGSV

Cypress Solutions Proprietary NMEA Sentences

Decimal ID	Message Name	Message description
136	$PACCEL	Acceleration/Deceleration with Modem ID, proprietary NMEA message- $PACCEL
138	$PACCEL2	Acceleration/Deceleration (2nd source) with Modem ID, proprietary NMEA message- $PACCEL2
04	$PAID	Asset IDs, proprietary NMEA message-$PAID
30	$PCTM	Network status, proprietary NMEA message- $PCTM
31	$PDATA	Wireless link TX/RX data count, proprietary NMEA message- $PDATA
X	$PEVENT	Trigger/event message - $PEVENT (CTM-200 only)

140	$PFUEL	FUEL ECONOMY with Modem ID, proprietary NMEA message- $PFUEL (CTM-200 only)
142	$PFUELR	FUEL RATE(L/100Km) with Modem ID, proprietary NMEA message- $PFUELR (CTM-200 only)
114	$PGPS	GPS with modem ID proprietary NMEA (based on RMC)- $PGPS
X	$PGRT	Geo-Route alarm/alert message with Modem ID - $PGRT (CTM-200 only)
141	$PIDLE	IDLE TIME with Modem ID, proprietary NMEA message- $PIDLE (CTM-200 only)
21	$PINA	Analog Input #1 status, proprietary NMEA message- $PINA
22	$PINA	Analog Input #2 status, proprietary NMEA message- $PINA
23	$PINA	Analog Input #3 status, proprietary NMEA message- $PINA
24	$PINA	Analog Input #4 status, proprietary NMEA message- $PINA
25	$PINA	Analog Input #5 status, proprietary NMEA message- $PINA
26	$PINA	Analog Input #6 status, proprietary NMEA message- $PINA
27	$PINA	Analog Input #7 status, proprietary NMEA message- $PINA
28	$PINA	Analog Input #8 status, proprietary NMEA message- $PINA
20	$PIND	Digital Input States, proprietary NMEA message- $PIND
115	$PKML	Proprietary NMEA message for Google Earth application (kmlserver)- $PKML
139	$PLACCEL	Lateral Acceleration with Modem ID, proprietary NMEA message- $PLACCEL (CTM-200 only)
151	$PMBM	Modbus slave device 1's state queried by Modbus Master, proprietary NMEA message- $PMBM,1 (CTM-200 only)
152	$PMBM	Modbus slave device 2's state queried by Modbus Master, proprietary NMEA message- $PMBM,2 (CTM-200 only)
153	$PMBM	Modbus slave device 3's state queried by Modbus Master, proprietary NMEA message- $PMBM,3 (CTM-200 only)
154	$PMBM	Modbus slave device 4's state queried by Modbus Master, proprietary NMEA message- $PMBM,4 (CTM-200 only)
150	$PMEX	Modbus Master Exception, proprietary NMEA message- $PMEX? (CTM-200 only)
03	$PMID	Modem ID, proprietary NMEA message-$PMID
29	$PNETD	Detailed Network status (output of RFSTATS), proprietary NMEA message- $PNETD
35	$PNETD1	Detailed LTE dynamic Network parameters (output of RFSTATS), proprietary NMEA message- $PNETD1?
36	$PNETD2	Detailed LTE static Network parameters (output of RFSTATS), proprietary NMEA message- $PNETD2?
119	$POBDA	OBD II Group A, proprietary NMEA message- $POBDA
120	$POBDB	OBD II Group B, proprietary NMEA message- $POBDB
121	$POBDC	OBD II Group C, proprietary NMEA message- $POBDC
122	$POBDD	OBD II Group D, proprietary NMEA message- $POBDD
123	$POBDE	OBD II Group E, proprietary NMEA message- $POBDE (CTM-200 only)
124	$POBDF	OBD II Group F, proprietary NMEA message- $POBDF (CTM-200 only)
125	$POBDG	OBD II Group G, proprietary NMEA message- $POBDG (CTM-200 only)
126	$POBDH	OBD II Group H, proprietary NMEA message- $POBDH (CTM-200 only)
137	$PODO	GPS Odometer with Modem ID, proprietary NMEA message- $PODO
116	$PPWR	Power status, proprietary NMEA message- $PPWR
117	$PRFI	CDMA/EV-DO Network diagnostic report, proprietary NMEA message- $PRFI
32	$PSNF	Store and Forward messages' Status NMEA message- $PSNF
34	$PSIG	Signal Quality Message (output of RFSTATS), proprietary NMEA message- $PSIG?
33	$PWIFI	Wifi Network status, proprietary NMEA message - $PWIFI

Other Vendor Proprietary NMEA Sentences

Decimal ID	Message Name	Message description
129	$BTVEG	Intergraph's GPS message- $BTVEG

Cypress Solutions ULCP Messages

Decimal ID	Message Name	Message description
85	ULCP	ULCP binary format GPS data message
88	ULCP	ULCP binary format acceleration/decleration event data with GPS
89	ULCP	ULCP binary format Modem ID/firmware revision/odometer data
90	ULCP	ULCP binary format odometer data
92	ULCP	ULCP binary format wireless Link TX/RX Data Count with Modem ID
93	ULCP	ULCP binary message for panicreport (CTM-200 only)
97	ULCP	ULCP binary format digital I/O with GPS (no events)
98	ULCP	ULCP binary format digital input event data with GPS
99	ULCP	ULCP binary format MIL status with number of DTC
112	ULCP	ULCP binary format modem ID with GPS
113	ULCP	ULCP binary format digital input/output (IO), modem ID, with minimal GPS (time,lat/lon,validity) (CTM-200 only)
255	ULCP	ULCP Custom Message- Flexible Format
255	ULCP	ULCP Custom Message for spreader controllers (CTM-200 only)

Other Message Types

Decimal ID	Message Name	Message description
40		Device phone number, PAD Port/Type, serial port baud
100	TAIP PV	GPS TAIP PV message
101	TAIP LN	GPS TAIP LN message

11.7 Report Triggered Scripts

The CTM-200 can be configured to execute a script or list of actions when a report is triggered. With report-triggered scripts enabled a series of commands can be executed by the CTM-200 that can perform a series of simple or complex tasks involving logic.   The script is a linux shell script file (.sh) file that resides in the CTM-200 non-volatile memory. The name of the script correlates to a specific report so whenever the report is triggered, the script will execute if script execution is enabled.

Reports need to be located in the **/var/data/reports/scripts** directory on the CTM-200. The file naming convention is reportN.sh where N is the report number, for example report9.sh would be a script that would execute based on general report 9 being triggered.

Note: For standard GPS and Input/Output reports the corresponding file based report number for GPS report 1 is report1020 and for IO report 1 is report1040.

The format for the script file

#!/bin/sh
…………….
………………………..
…………………………………..
…………………

Shell scripts must also respect Unix line endings. If written using a windows editor CR/LF must be stripped from the file, this can be performed after the file is copied across to the CTM-200 using the "dos2unix" utility.
Shell scripts must have their mode changed to executable, this is accomplished by using the chmod command, ie chmod +x "filename.sh"

11.8 File Based Reporting

In addition to providing real time reporting, reports can be stored in files. One advantage to file based reporting is that the trigger mechanism or reporting interval can be set to a high frequency above practical means for real time reporting. The reports can be compressed into a "zip" format for easy archival and delivery.

11.9 Store and Forward

All reports can be enabled to utilize the "store and forward" feature of the CTM-200. Store and forward allows the CTM-200 to store reports in non-volatile system memory when the device is out of Wireless coverage (Cellular or Wi-Fi).   The CTM-200 uses internal logic that determines when the wireless signal is at a level where the real time delivery of data would be compromised. When it detects this condition the reports are stored in memory. When the logic detects that the wireless signal is once again acceptable the stored reports are forwarded.

12 System and Event logs

The CTM-200 logs operating system events as they happen. The most verbose log is the system log or syslog. The syslog captures all device events as they occur. The system log is volatile; the contents of the system log are lost on a power reset. Syslog can be captured to a file or connected computer for persistent logging

The Event log is a non-volatile log that logs and optionally reports all important firmware events such as cellular/wifi network connectivity, firmware generated power cycle, firmware updates, etc.

The event log will grow until cleared or it will roll over when its memory capacity is reached (> 1 year of logging). Event logs can be automatically delivered via the CTM-200 reporting system.

An example of a partial event log:

```
Mon Jan 13 08:47:22 PST 2014 [36]:POWER_UP:00000001
Mon Jan 13 08:47:22 PST 2014 [36]:IGN_ON
Mon Jan 13 08:47:22 PST 2014 [36]:WIFI_AP_UP
Mon Jan 13 08:47:22 PST 2014 [36]:CELL_ONLINE 0 mins 36 secs after POWER_UP, RF Quality: 17%
Mon Jan 13 12:46:46 PST 2014 [14400]:HEALTH
Mon Jan 13 16:37:28 PST 2014 [28241]:CMD_DATA_RESET:OK
Mon Jan 13 16:46:46 PST 2014 [28800]:HEALTH
Mon Jan 13 20:46:46 PST 2014 [43200]:HEALTH
Mon Jan 13 20:47:08 PST 2014 [43222]:CELL_OFFLINE after 719 mins 46 secs online, RF Quality: 32%
Mon Jan 13 20:47:26 PST 2014 [43240]:CELL_ONLINE after 0 mins 18 secs offline, RF Quality: 31%
Tue Jan 14 00:46:45 PST 2014 [57600]:HEALTH
Tue Jan 14 04:46:46 PST 2014 [72000]:HEALTH
Tue Jan 14 08:46:45 PST 2014 [86400]:HEALTH
Tue Jan 14 08:47:19 PST 2014 [86433]:CELL_OFFLINE after 719 mins 53 secs online,
Tue Jan 14 08:47:32 PST 2014 [86446]:CELL_ONLINE after 0 mins 13 secs offline, RF Quality: 30%
```

The event log can be configured for different levels of verbosity, an example of a partial event log is shown above. POWER_UP:00000001 indicates a power on condition and the nature of the power, ignition, reset, etc. CELL_ONLINE events record when cellular connections are established and CELL_OFFLINE record when offline conditions occur. HEALTH events are messages that indicate the CTM-200 operating system is operating normally. The default configuration for a HEALTH message is once every 4 hours.

13 Connection monitoring tools

Watch dog timers are used to monitor network connectivity and reset the network connection or CTM-200 if a timer expires indicating a network connectivity issue.

- Setup a ping target to generate network traffic
- Configure the network watchdog for cellular traffic
- Configure a watchdog timer for the Wi-Fi network.

14 Security

14.1 Remote Access Control

Remote access control can limit remote access to the CTM-200 embedded Web pages or command line consoles (Telnet/SSH). Telnet and SSH connections are password protected with a configurable password.

14.2 Friends list

Block incoming packets from an IP address that is not defined as a "friend". Eight Friends list IP addresses can be defined.

14.3 LAN Friends

LAN Friends is used to control access to PC devices connected via the CTM-200 Ethernet ports. Up to 8 MAC addresses can be allowed Ethernet access, all other devices will be denied packet forwarding and routing.

14.4 Radius

The CTM-200 LAN ports and Wi-Fi interface supports 802.1x Radius authentication servers.

15 Networking

15.1 VPN

15.1.1 IPsec

The CTM-200 supports IPsec VPN communications.

The CTM-200 uses the KAME ipsec-tools: setkey tool to manipulate the Security Policy Database (SPD) and Security Association Database (SAD), and the raccoon Internet Key Exchange (IKE) daemon within the OpenCTM Linux 3.2 environment.

To successfully setup an IPSec communication tunnel between a CTM-200 and other VPN hardware a variety of settings must be configured. A partial list required to begin to create a test environment is below:

- server public IP
- server LAN IP subnet / netmask
- a pre-shared key for IPSec
- transport type : ESP / AH
- IKE Encryption and Diffie-Hellman Group eg. 3DES with Group 2 (1024-bit prime)
- encryption algorithm eg AES256, DES, 3DES
- hash algorithm eg. MD5, SHA1

15.1.2 VPNC

VPNC is a simplified IPsec/VPN client application that was developed as a Linux alternative to the Cisco Easy VPN Client software for PCs. VPNC was initially developed to interoperate with Cisco VPN Concentrators and PIX/IOS routers, but may work with other similar equipment.

- Authentication method using Pre-Shared-Key + XAUTH is known to be insecure. For more details see the Cisco Security Notice at www.cisco.com/warp/public/707/cisco-sn-20040415-grppass.shtml
- Limited configuration options, may not work with all equipment
- Limited routing capabilities: VPNC is used to create a tunnel between the client (CTM-200) and the server; it is not a site-to-site solution such as Racoon/IPsec which can be used to connect remote subnets.

16 Engine Diagnostics Support

As part of the general reporting system, the CTM-200 is capable of monitoring a variety of Engine Diagnostic parameters.   These parameters can be used as events or triggers to generate reports. In addition to the reporting of real time Engine parameters the CTM-200 processes key parameters to deliver accumulated values for fuel consumption, fuel rate, Idle time and engine hours. Engine Diagnostic support is available via the CTM-200 on board CAN interface. The CAN interface supports vehicles using the ISO-15765-4 (2008 and newer small and light duty vehicles) protocol and the J1939 protocol (heavy duty vehicles). Vehicles that do not support the CAN interface can be supported using the Cypress Solutions E-VDT (Engine vehicle diagnostics transmitter). When CAN support has been enabled on the CTM-200 and the cables connected. Engine/vehicle parameters will be available to the CTM-200. The CTM-200 can use the available Engine/Vehicle parameters for accurate real time calculation of:

- Total Fuel[1]
- Fuel Rate[1]
- Total Engine Hours
- Total Idle Time
- Total Odometer[2]

   [1] Fuel calculation is dependent on the vehicle ECU providing a parameter that can be used to determine fuel consumption such as MAF (mass air flow) sensor or fuel tank level values.

   [2] In some cases Vehicle odometer is available from the vehicle ECU, in cases where this is not available the on board odometer on the CTM-200 can be set to match the vehicle odometer

The above values are stored in non-volatile internal memory on the CTM-200 are available to AVL tracking applications.

In addition many other Engine/vehicle parameters are available. Engine/vehicle parameters vary based on vehicle make, model, and year of manufacture. Contact Cypress Solutions for a complete list of supported vehicles.

For vehicles where the connection to the vehicle ECU is not possible or not available the CTM-200 can take advantage of GPS sensor information and calculate an accurate GPS based **odometer** value.

17 Geo-Routing

The CTM200 has the ability to generate reports based on a mobile asset or vehicle location with respect to a list of pre-defined routes stored locally on the CTM-200. Up to 32 routes can be defined; each route can be either series of points defining a route, a series of points defining an area, or a single point. The trigger event is when the vehicle enters or leaves the route or area. When a geo route trigger occurs a report is generated that is appended to an existing general report.

18 Accessory or 3rd party product support

18.1 PAD Mode

PAD Mode or Packet Assembly or Disassembly is used to allow the CTM-200 to act as a "virtual serial port" and route data from devices such as PLC (programmable logic controllers), etc. to server applications where the data can be viewed as native serial data for analysis. Serial data can be bi-directional from the remote side to the server or vice versa.

18.2 MODBUS

For devices that support MODBUS communications the CTM-200 supports MODBUS Slave, MODBUS Slave Gateway and MODBUS Master Gateway, MODBUS Master

18.3 Man Down Pendant

The CTM-200 has integrated support for the Cypress Solutions Man Down Pendant.   The Man Down system uses a 2.4 Ghz 802.15.4 wireless personal area network (WPAN) to communicate with the CTM-200.   With the optional 802.15.4 2.4 Ghz radio installed the CTM-200 can act as a cellular gateway for the Man Down Pendant. Messages received from the pendant can be relayed to remote servers; in addition remote servers can "page" the Man Down Pendant from the remote server. Each Man Down pendant has a unique 16 digit hexadecimal ID that identifies the Man Down Pendant. Acknowledgements to Man Down alerts can be gateway acknowledged for server acknowledged for true closed loop operation. Up to 16 Man Down pendants can be supported by one CTM-200

Note: The CTM-200 requires an optional WPAN radio module to be installed to communicate with the Man-Down Accessory.

18.4 Garmin® Personal Navigation Devices

The CTM-200 supports Garmin® products that support the Fleet Management Interface (FMI). When connected to the CTM-200 via serial link the CTM-200 manages the local connection between the Garmin® and the CTM-200 and the wireless link between the CTM-200 and the remote server. The CTM-200 notifies the remote server when the Garmin is connected or disconnected.

The CTM-200 support for the Garmin® product uses a modification of the standard PAD (Packet Assembly Disassembly) feature of the CTM-200. Default configuration set by the selecting the Garmin® mode on the CTM-200 can be over ridden by individual configuration of the CTM-200 PAD settings.

Remote Server <----> Internet <--^{WAN}--> CTM-200 <--^{Serial}-->Garmin

Note: The CTM-200 communicates with Garmin® (NUVI) products which support the Garmin FMI interface and the associated Garmin USB to serial cable.

18.5 Miscellaneous external devices, salt spreader controllers, etc.

In some cases specialized auxiliary equipment are connected to the serial port(s)/CANBus on the CTM-200. Output from this equipment can be added as a "message payload" and delivered to the monitoring server. This allows applications to receive data from the connected devices. The data payload is appended to the $PGPS report message (114) or as binary payloads. The $PGPS message or binary messages are generated when the data is received on the CTM-200 serial port either via polling or when data is received by the CTM-200.

Auxiliary device support is a highly configurable feature of the CTM-200.
Parameters such as device name, leading characters, terminating characters, amount of bytes to read, polling or non-polling or whether any processing of the incoming data is required can be configured.

Example 1:

A Salt spreader controller is connected to the CTM-200, The output from the spreader controller is:

131213141516171819202122232425262728293031

The Corresponding report message:

```
$PGPS,000000.00,V,0000.0000,N,00000.0000,E,000.0,000.0,000000,+00000,0,131213141516
17181920212223242526272287293031*7E
```

Example 2:

A weight sensing interface is connected to the CTM-200, The output from the weight sensor is:

```
LBFF55;iiiii;cccc;aaaaaa;u;rrrrrrrrrrrrrrrr;SGGG.GGGGGG;STTT.TTTTTT;xx<CR><LF>
```

The corresponding report message:

```
$PGPS,002349.00,V,0000.0000,N,00000.0000,E,000.0,000.0,060180,+00000,0,1234567890,L
BFF55;iiiii;cccc;aaaaaa;u;rrrrrrrrrrrrrrrr;SGGG.GGGGGG;STTT.TTTTTT;xx*53
```

18.6 Access Control

The CTM-200 supports the I-Button® and HID® proximity card systems for access control. The access control devices can be connected via serial or GPIO connector on the CTM-200. The CTM-200 supports both wiegand and serial protocols. The CTM-200 can be configured to execute "scripts" on lock and unlock. For example, an unlock script may trigger an output to control a relay that enables vehicle ignition. The CTM-200 can also store an "Access control list" which is a list of ID's that are "valid" . When an access control request is made, the ID from the button or card is compared against a stored list on the CTM-200. If the ID is valid an unlock script would execute, unlocking a door, or enabling ignition. When an attempt is made at access control the CTM-200 generates a report message containing the ID of the button or card and whether the card is a valid or invalid

card based on the stored list on the CTM-200. The ID payload is appended to the end of the $PGPS message, message 114. The message is automatically generated when an access control attempt is performed.

Example:

A access control attempt is made using a button or card. The ID of the button/card is:

039-30391

The corresponding message is:

```
$PGPS,171134.00,A,4915.3868,N,12259.8049,W,000.0,000.0,170609,+00004,5,09604890958,
039-30391,V*33
```

where "V" indicates the ID is a valid ID as compared against an internal list stored on the CTM-200. "F" would indicate an invalid ID.

18.7   RF Switch

The CTM-200 supports an accessory RF switch/speed buzzer that is used to disable radio communications in areas where radio emissions are prohibited (blasting areas). The accessory has a super bright LED indicating when the CTM-200 radio(s) are off and a buzzer that can be triggered when a speed threshold has been exceeded.

18.8   CTM-200 with integrated Iridium™ ISU module

The CTM-200 supports an integrated Iridium Satellite module for communications when cellular coverage is not available. The CTM-200 has internal logic that manages the transition from Cellular to Satellite and back to Cellular. Standard CTM-200 reports, Packet Assembly/Disassembly (PAD) data and console commands and Man Down alerts can be transmitted via Satellite.

18.9   CTM-200 with integrated battery backup

An optional internal battery is available for the CTM-200 that allows it to operate for 2-3 hours if the main power supply has been disconnected from the CTM-200. This is useful for applications where the main power is not reliable.

Technical Support

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