RTKonnect ®
User Guide

December 2017

Firmware 2.8+

WiFi, BlueTooth, Serial NTRIP Client Device

Back 40 Precision Inc is a member BlueTooth SIG.

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Product Description:

The RTKonnect is a smart communication device for the delivery of Real Time Kinematic (RTK) data to a mobile GNSS receiver. The RTKonnect contains both a WiFi radio transceiver and a BlueTooth radio transceiver along with two RS232 serial data ports. The unit will automatically search for a current data connection source by prioritizing BlueTooth, WiFi, and Serial modem connections in that order. It contains an easily configured NTRIP / TCP client allowing little operator interaction for either the WiFi or Serial modem connections.

Specifications:

1- RS232 Serial connection COM2 for configuration, secondary output, Serial IP modem connection and / or GGA input
baud rate 19200-115200 bps, 8N1
1- RS232 Serial connection COM1 for receiver communication
baud rate 19200-115200 bps, 8N1, Generic NTRIP mode
baud rate device controlled, emulating radio mode
BlueTooth transceiver
SIG qualified class 2, BlueTooth 2.1 standard, Tx power 4dBm, supports SPP (serial port protocol)
AES128 encryption, error correction, greater 60ft range, EZ discovery
WiFi transceiver
802.11b/802.11g, TCP IP, DHCP address, Tx power 12dBm, mixed mode WPA/WPA2, range greater 60ft
enclosure rating IP67 / 3ft submersion
temp range –55 C to 125 C
input voltage 5 to 24 DC, less than 300mA current draw

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Warranty and Limitation of Liability

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Connectivity:

Available harness options:

GENERIC cable: consists of two 9pin serial port connections, a power/ground lead and a 12 pin DTM connector which plugs into the RTKonnect. Serial Port1 is the receiver connection. Port2 is the configuration connection and auxiliary functions. This cable is used with a wide range of receivers. Including AgLeader 6500, 2500, Geosteer, Raven Phoenix300, S600, Novatel, Leica, and others.
TrimbleCFX/FMX cable: Port1 has a 12pin DTM connector which plugs into the display corrections port.
TrimbleAgGPS cable: 252,262,372 Port1 has a 12pin DTM connector which plugs into the receiver Port B.
TrimbleAgRadio cable: Ports 1 and 2 are in a 12 pin DTM connector which plugs into the receiver Port B connector. This cable is used only if emulating an AgGPS900 joey radio.
Paradyme cable: Port1 is a 12 pin DT connector and plugs into the black connector on the left side underneath of the Paradyme unit.
TopCon/AGCO AG cable: Port1 is a DT connector and plugs into the secondary port on the receiver.
JDradio cable: Port1 is a 4 pin DT connector and plugs in place of the FM radio on the receiver.

On most cables Serial Port COM2 will be a 9 pin DB serial cable end. This will be used for initial configuration. It can also be set to be set to operate in different modes.

COM Ports: Connect the appropriate harness to your GNSS receiver's correction input port. Refer to your receiver's manufacturer's manual for the appropriate connection.
Com1 - Used as primary receiver connection. Baud rate is adjustable in Generic Client Mode.

Com2 -
Under Generic Client Mode:
Secondary output / SerialIP: If the device has not yet found a data source it will send an NTRIP login request out of the serial port. If it is connected to a serial modem this can facilitate a NTRIP server connection. If the device is already streaming data by WIFI or BlueTooth connection then this serial port will output the same correction stream being sent to the primary receiver. This can be used for a second receiver if desired.
Serial Input Only: In some areas it may be desired to connect an FM radio link to this port if cellular service is not able to maintain a datastream. If the device has not found a WIFI or BlueTooth data source it will forward data received on Port2 directly to the receiver.
Under Radio Emulation Mode:
GGA Position Input Only: This port listens for a position message from another port on the receiver in order to send this information back to the caster.
Secondary Correction Output: This port sends the correction data stream out this port. This can be used for a second receiver or connected to a local FM radio to transmit corrections to another machine in close proximity with a receive radio.

BlueTooth:
The BlueTooth connection can be used with an NTRIP client application on an Android or Windows device. The RTKonnect acts as a data pass through when the BlueTooth connection is sensed. Refer to your Android or Windows device manual for instructions on pairing. Once you discover the RTKonnect you may need to enter a PIN code the first time for pairing to complete. If the PIN code is not automatically visible on your phone or tablet device then enter this PIN code 1234.
BlueTooth has priority when connected. The RTKonnect will close a WIFI connection when the BlueTooth is activated. If the BlueTooth connection is closed, the RTKonnect will begin searching for a WIFI or serial data source again. This happens without operator input.

WIFI:
The RTKonnect has an intelligent WIFI transmitter inside. One configured the device will search for the programmed WIFI access point (also called a hotspot). It works well on cell carrier hotspot devices, modems with a WIFI hotspot function, and phone or tablets with the hotspot turned on. If you have an iOS device either iPhone or iPad you may need to check with your cellular network provider to see if the hotspot function is part of your current cell plan.

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Device Operation

The RTKonnect will seek the programmed WIFI hotspot. As soon as it finds the WiFi hotspot the *yellow* LED will blink slow. If the unit is ready to connect, the RTKonnect will open a port to the preprogrammed server. If a port is successfully opened to the server the *yellow* LED will light solid. The RTKonnect has an internal NTRIP client to handle server login protocol but can also be used for a simple TCP connection RTK datastream. If the server accepts the login, correction data will begin streaming to the receiver connected to COM1. Upon an accepted response from the server, the *red* LED will light solid. The function of COM2 will depend on the way the RTKonnect has been configured.

If you open a connection to the BlueTooth adapter, the *green* LED will light solid. The RTKonnect will then close any open WiFi connection and act like a BT serial dongle. It will forward and data received from the BT device to the receiver. It will continue to check for a GGA position message from the receiver. If it finds a GGA it will forward that to the BT device.

If another connection has not yet been made, the RTKonnect while in Generic Mode will attempt to send a login message out COM2. If it is connected to a data modem with a VPN setup, the RTKonnect can facilitate a server login this way. This is referred to SerialIP.

If at any time the current server connection is lost, the RTKonnect will begin searching for any available connection method. This makes the RTKonnect a fully autonomous RTK Client Device.

Configuring the RTKonnect

The RTKonnect is programmed to be able to be configured by serial Com port 2 or by BlueTooth connection. At this time we do not have a BlueTooth Android App available.

You will need to download Back 40 Precision's ***EZ-Config Utility*** software tool from our website. http://www.back40precision.com/downloads. A Windows computer with either a serial port or a USB to serial adapter is required. (**Refer to the EZ-Config Utility User's Guide for more information)**
Connect the computer to the RTKonnect COM2. Open the software and select the serial port from the drop down list of the computer's available ports. Select the baud rate the RTKonnect is set to operate at. The default is 115200.
Press the "connect" button. When the device is captured the current device settings will appear in the left column of the screen. If you wish to copy these settings press the "copy current settings" button. It will copy the current device settings to the right column. Enter your server login information and WIFI access point information.

Select the connection mode:

Connect on Receiver GGA Only: If this is checked the WiFi client will only attempt to connect to The server if a GGA message was detected from the receiver. If 45 seconds pass without a GGA message, the RTKonnect will close the server connection.

Select the server address type:

Use IP address for server: Enter the numberical IP address such as **192.168.1.120**
Use WEB address for server: Enter the WEB address of the server such as **rt.igs.org**
Do not include leading www. Or http://

Select the mode of operation for the RTKonnect:

Generic Client: will be used for most receivers
AgGPS900 radio: will be used for 252,262,372 receivers in most situations
JD/SF900 radio: will be used with SF receivers

Select the WiFi connection type:

NTRIP: used with most servers. Requires a login, password, address and port
TCP: simple address and port only needed.

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Select the COM2 operating modes:

If Generic Client mode:

2nd output / serialIP: second correction output with attempt to connect by SerialIP

Serial data input only: Used for an external receive FM radio

If emulating radio mode:

GGA input only: listens for GGA from the receiver

2nd correction output: sends corrections out for another receiver

Select the Manual Position:

Enable Backup GGA: This will enable the backup auto GGA message using coordinates you provide.

Enter the Server address:

Enter either the server IP address or web address.

Enter the Server access port:

Enter your NTRIP login information: *(greyed out if you selected TCP)*

Enter your NTRIP password: *(greyed out if you selected TCP)*

Enter your NTRIP stream name: *(greyed out if you selected TCP)*

Enter your WiFi hotspot's name:

Enter your WiFi hotspot's password:

Enter backup Latitude if desired: format DDMM.SS example **3812.64**

(note – negative sign denotes South Latitude and West Longitude)

Enter backup Longitude if desired: format DDDMM.SS example **–09145.32**

When ready press the UPDATE UNIT DATA button.
After receiving confirmation message press the DISCONNECT button.
You must repower the RTKonnect for all changes to take effect.

Operating Modes:

The first is "Generic NTRIP". The RTKonnect will operate as a standard NTRIP client or TCP client.
The second mode is "AgGPS900 radio". In this mode the RTKonnect emulates a Trimble AgGPS900 RTK radio. It will appear seamless to Trimble based receivers. Baud rate is variable in this mode and is determined by commands sent by the receiver. Only the GNSS receiver connection of the RTKonnect is affected by the operating mode. NTRIP client functions remain unchanged.
The third mode is "JD/SF900 radio". The RTKonnect will emulate a JD radio.
In a Radio Emulation Mode, COM1 baud rate will be greyed out and is preset in software inside the RTKonnect.

Diagnostic LEDs:

The RTKonnect has several easy to understand diagnostic LED's.
On one side there are three LED's in a row.
YELLOW
RED
GREEN
On the other side of the unit is a Red power indicator LED.

GREEN	solid	= BlueTooth connection active
YELLOW	slow flash	= WiFi connected to access point
YELLOW	solid	= WiFi connected to server port
RED	slow flash	= searching for NTRIP connection
RED	solid	= NTRIP server connected
RED	fast flash	= booting/configuring WiFi module
RED and YELLOW	fast flash together	= device is captured by the computer for configuration.

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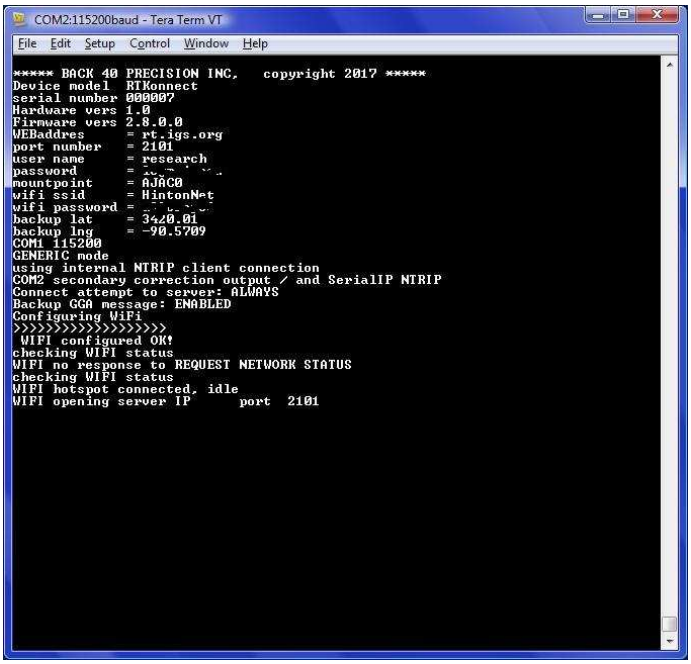
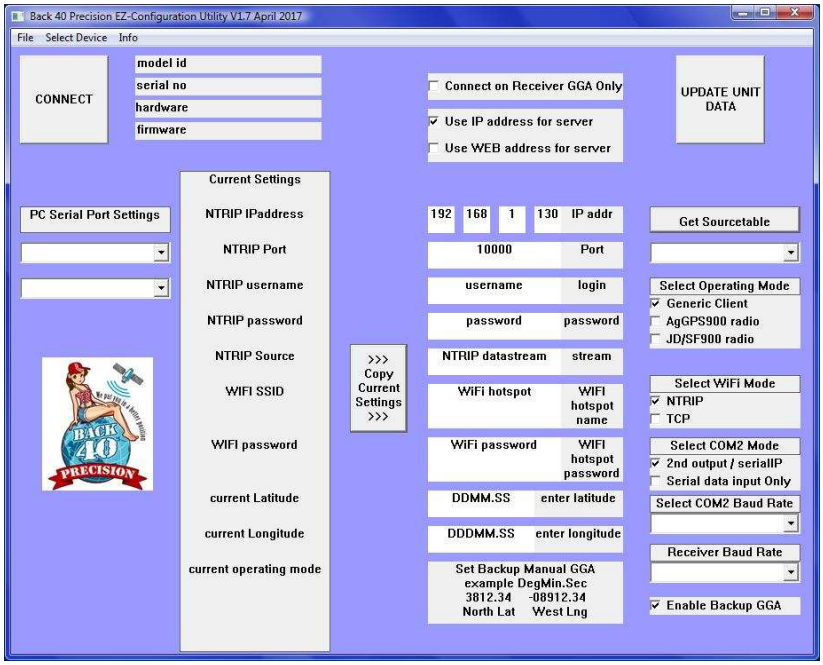
Diagnostics / Troubleshooting

On power-up the RTKonnect sends Text out COM2 showing all current settings. While not yet streaming correction data it will continue to send out informational messages. These can be read on a simple serial terminal program.



When connected to the EZ-Config Utility all the device settings will display in the left hand column labeled ***Current Settings***. See example below.



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Cannot connect to WiFi hotspot: Check your hotspot name and password. These must match.

Cannot connect to server / caster: Verify your login and password information is correct and that your subscription has not expired. Verify the server IP or WEB address and port number are correct. The RTKonnect has been tested with nearly all common caster software used today.

Cannot connect RTKonnect to EZ-Config Utility software: Try each of the four possible baud rates on the RTKonnect. (19200, 38400, 57600, 115200) If the device COM2 baud rate was set to 19200 then you must set the EZ-Config software to 19200. Verify you are selecting the correct serial port on your computer.

Section 2: Use with AgGPS252, AgGPS262, Ag372 most uses including CNH machines

Set RTKonnect in "Generic" mode.

Connect to receiver with '**252_262_372_Generic'** harness to receiver **port B** connector.

Use CNH factory display or computer with Trimble's AgRemote software.

Set the receiver **Port C** using the AgRemote or RDI tab on CNH displays.

Port C should be setup as follows. (if using RTCM data on an Ag372 then select RTCM)

CFG: I CMR baudrate 8N1 O NMEA baudrate

You may select a baud rate that matches any of those offered on the RTKonnect. Make certain to set the RTKonnect receiver port to the same baud rate for communication to function properly.

Use the down arrow in the **Port C** menu until you see the NMEA message configuration. Make certain GGA is in capital letters. You may turn off all other NMEA messages. GGA must be sent back through the RTKonnect for most "network" or "nearest" type caster data streams.

CFG: NMEA1 GGA gll grs gsa gst gsv

Please NOTE:

The Generic cable and operating mode should work for most receivers. There were some particular display, NAV2 controller, and receiver firmware combinations which prevented the receiver from using port C for correction data. For those situations it is advisable to update firmware on the machine so port C data will function. If this is not possible the RTKonnect can be set to emulate a Trimble 900Mhz joey radio. This function is described in *Section 3*. A specific CNH cable is needed or repining the generic cable ends. See the cable schematics ***Section 5*** at end of this document.

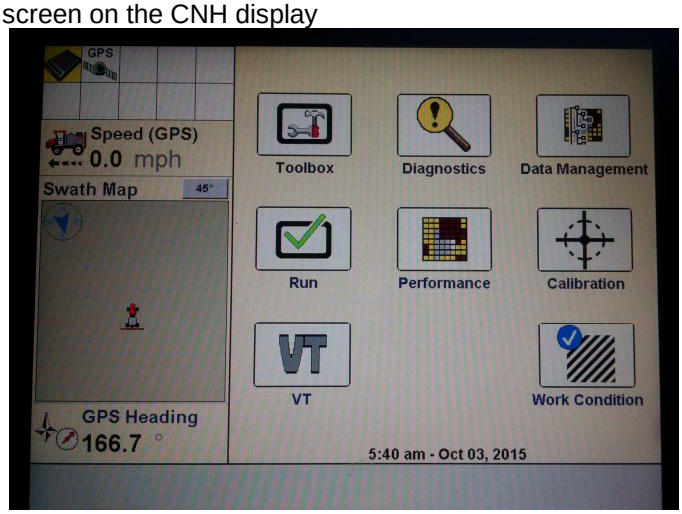
Section 3: Use with AgGPS252, AgGPS262, Ag372 CNH equipment - emulating 900Mhz radio

RTKonnect set in AgGPS900 Radio Emulation Mode

Connect the RTKonnect with the CNH link cable. Configure the RTKonnect to operate in AgGPS900 Radio emulation mode. *See the EZConfig software Users Guide*

Use the CNH factory display or a computer setup with Trimble's AgRemote software to configure the receiver. Using the CNH factory display is outlined here.

Start from the main screen on the CNH display



Using the "Toolbox" button and the "GPS" tab set the DGPS Type to RTK.

This will enable option choices for RTK Configuration which would otherwise Not be available.

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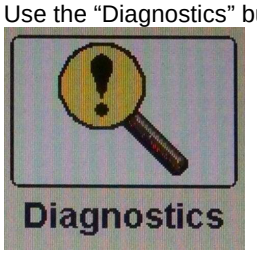
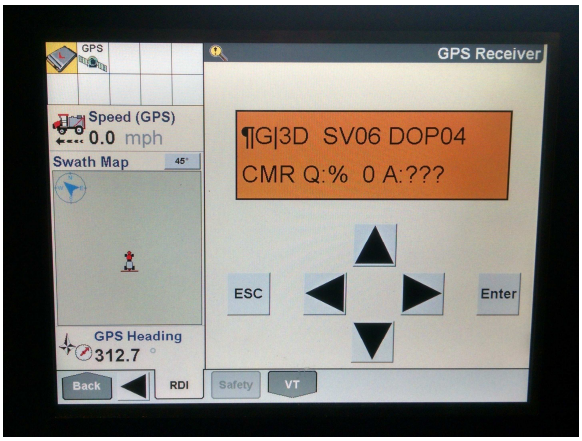
Use the “Diagnostics” button



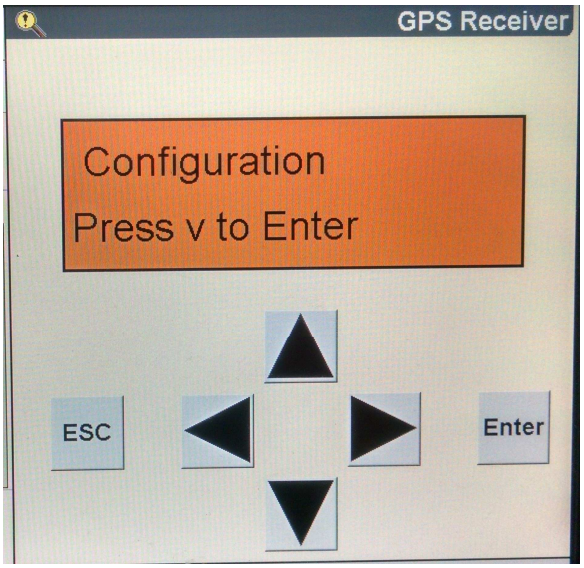
Select the RDI tab.

This opens direct communication with the receiver.



Press the RIGHT ARROW button 2 times to get to “Configuration”.

Press the DOWN ARROW once to enter The various configuration menus.



Use the RIGHT ARROW to move to Port B.

Press the DOWN ARROW to enter the menu.

Use the ARROW keys to make changes to Port B settings as follows for AgGPS262 And Ag372 receivers. For AgGPS252 you Will need to leave the settings at 9600k.

Exit back to “Configuration”.

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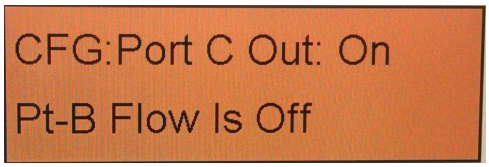
Use the RIGHT ARROW to move to Port C.

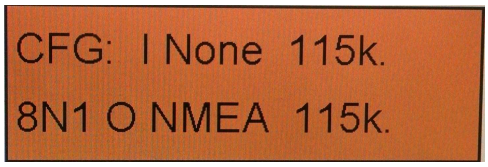
Press the DOWN ARROW to enter the menu.

Use the buttons to set Port C Out: to ON.

Press the DOWN ARROW

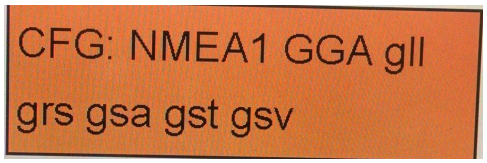


Use the buttons to set “I” input to None
And “O” output to NMEA at 115k.



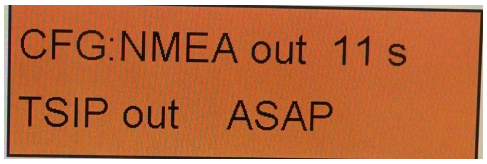
Use DOWN ARROW to get to NMEA message.

Output configuration. Turn GGA on by making it appear in capital letters.



Use DOWN ARROW to set the output

Rate in seconds. This must be less than 20 Seconds or the RTKonnect will use the Backup Manual Latitude and Longitude.

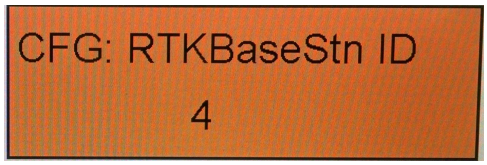


Exit to “Configuration”.

Use the Left or Right Arrow button to reach “RTK Config”.

Press the DOWN ARROW to enter the menu.

Use the DOWN ARROW to reach “RTKBaseStn ID”. Use the buttons to set the station number to match the station your RTK source transmits in the CMR datastream.
IMPORTANT: This number must match
Or the receiver will ignore the data
Dependant on receiver firmware.



Use the DOWN ARROW to reach “Delivery”.
Use the buttons to set it to “Trimble CMRRadio”.

Exit back to the main screen.

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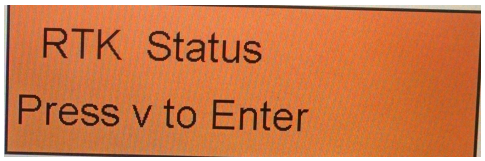
Checking the STATUS:

Use the RIGHT ARROW to reach “STATUS”.
Press the DOWN ARROW to enter the menu.



Use the RIGHT ARROW to reach
The “RTK Status”.

Press the DOWN ARROW until reaching
“Radio Product”.

The RTKonnect will show up as
“AgGPS900”.

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Section 4: command lines ASCII control messages

Communication Command Lines: ASCII text based commands

$DIAG turns diagnostic information messages on and off on Diagnostic/Modem serial port.

$CONFIG enters a configuration mode, this mode accepts a configuration command line.

$STATUS sends current settings back in a single ASCII text line.
$DEVICE, ModelID, SerialID, HardwareVers, FirmwareVers, NTRIP_IPaddress, NTRIP_Port, NTRIP_login, NTRIP_password, WIFI_ssid, WIFI_password, END

$SET (fill any spaces with the '**%**' character)

older
$SET,IPaddress,port,login,password,mountpoint,WIFI_ssid,WIFI_password,END
v2.7.0.0
$SET,IPaddress,port,login,password,mountpoint,WIFI_ssid,WIFI_password,configbyte1,END
v2.8.0.0+
$SET,IPaddress,port,login,password,mountpoint,WIFI_ssid,WIFI_password,configbyte1configbyte2,END
no spaces or comma between the config bytes

config program shows success when RTKonnect sends back an identical $STATUS message as the sent $SET command.

$CLEAREEPROM,END force erases of all stored settings **v2.8.2.0+**
$EXIT,END exits configuration mode.

Config byte value firmware v___ to v2.7.0.0

xxxx xx00 = Generic client mode
xxxx xx01 = Trimble AgGPS900 radio
xxxx xx10 = Trimble modem (unused)
xxxx xx11 = JD/SF900 radio
xxxx x1xx = use TCP
xxxx x0xx = use NTRIP
xxxx 1xxx = use Com2 as input only (exterior backup receive radio)
xxxx 0xxx = use Com2 as 2nd output and SerialIP attempt connect

x00x xxxx = 115200 com2 baud
x01x xxxx = 57600 com2 baud
x10x xxxx = 38400 com2 baud
x11x xxxx = 19200 com2 baud
xxx1 xxxx = connect on GGA ONLY
xxx0 xxxx = connect attempt ALWAYS
1xxx xxxx = manual backup GGA ENABLED
0xxx xxxx = manual backup GGA DISABLED

Config2 byte value firmware v2.8.0.0 + (additional)

xxxx xxx1 = use IP address
xxxx xxx0 = use WEB address
xxxx xx1x = com2 forward corrections out Radio emulation only
xxxx xx0x = com2 GGA position in only

x00x xxxx = 115200 com1 baud generic client only
x01x xxxx = 57600 com1 baud generic client only
x10x xxxx = 38400 com1 baud generic client only
x11x xxxx = 19200 com1 baud generic client only

old firmware v1.0 only

$MENU enters a step by step configuration menu over serial port or BlueTooth SPP

If entering any spaces use the “%” in place of a space, example: “abc%xyz” instead of “abc xyz”
Enter NTRIP Caster IP address, example 123.123.123.123" include period spacers in IP address
Enter NTRIP Caster port number, example 1021
Enter NTRIP Caster login or user ID
Enter NTRIP Caster password
Enter NTRIP Caster source, mountpoint or stream name
Enter WiFi SSID example Verizon-MiFiXXX-XXXX
Enter WiFi password
is this correct? Y or N

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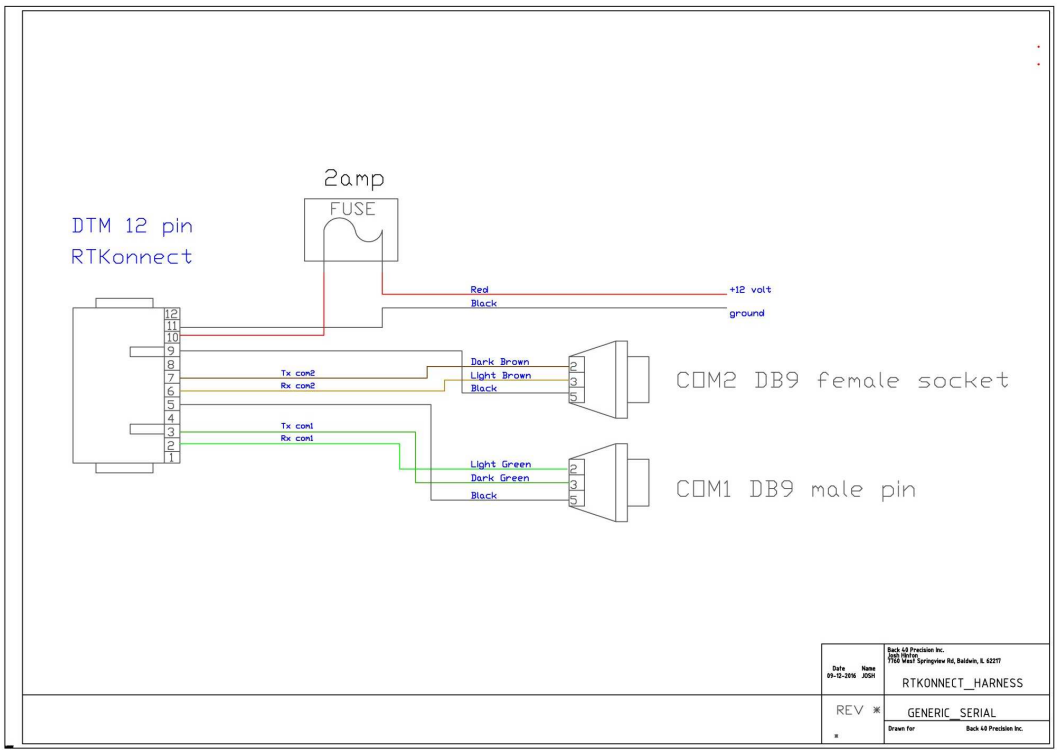
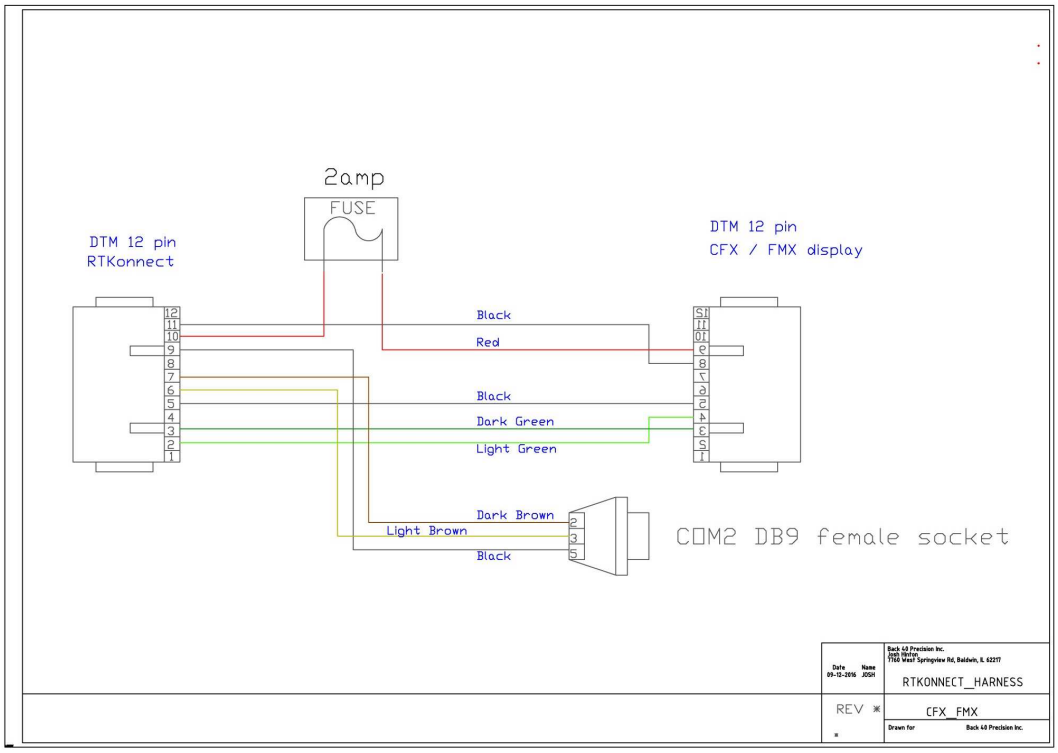
Section 5 wire schematics





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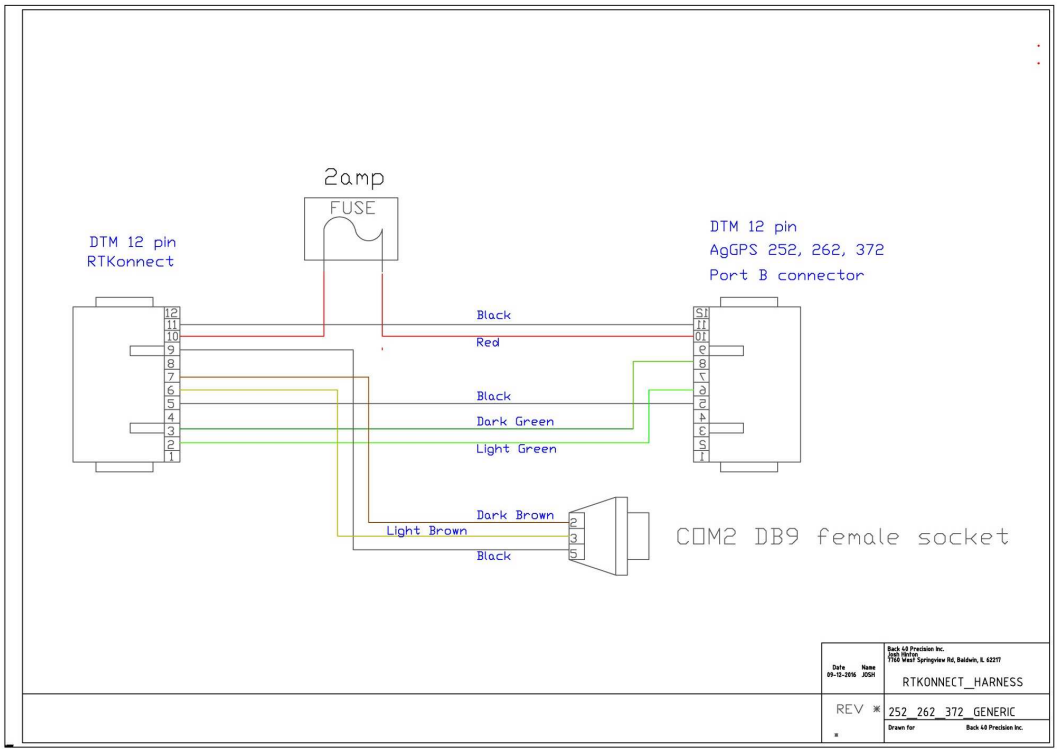

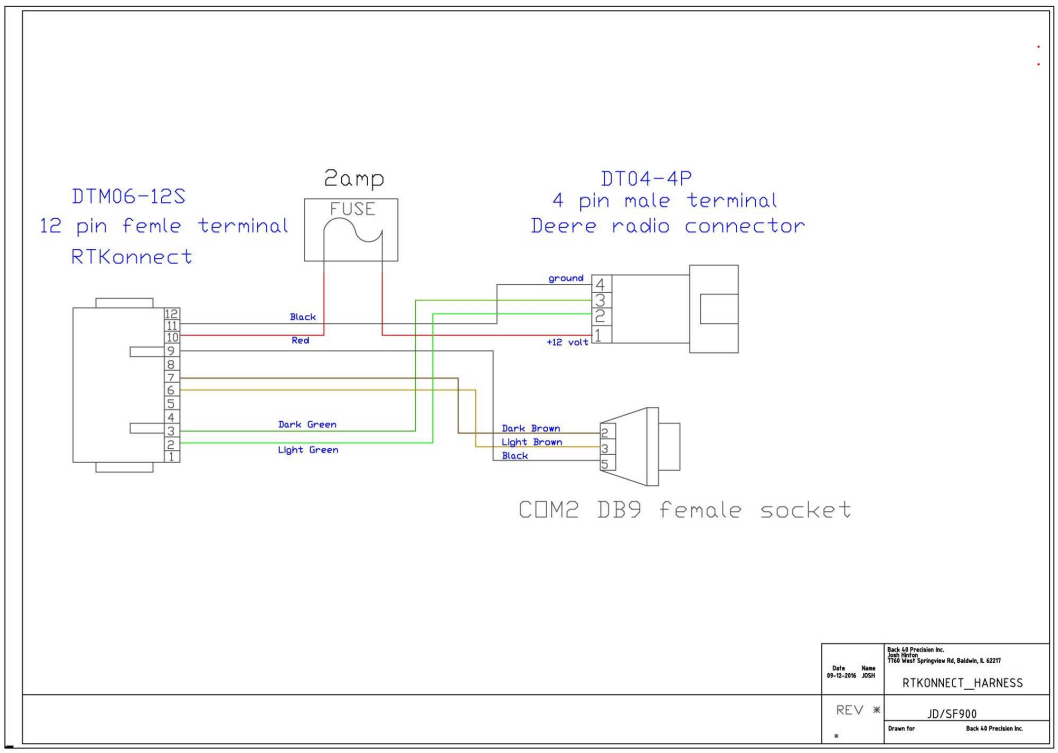

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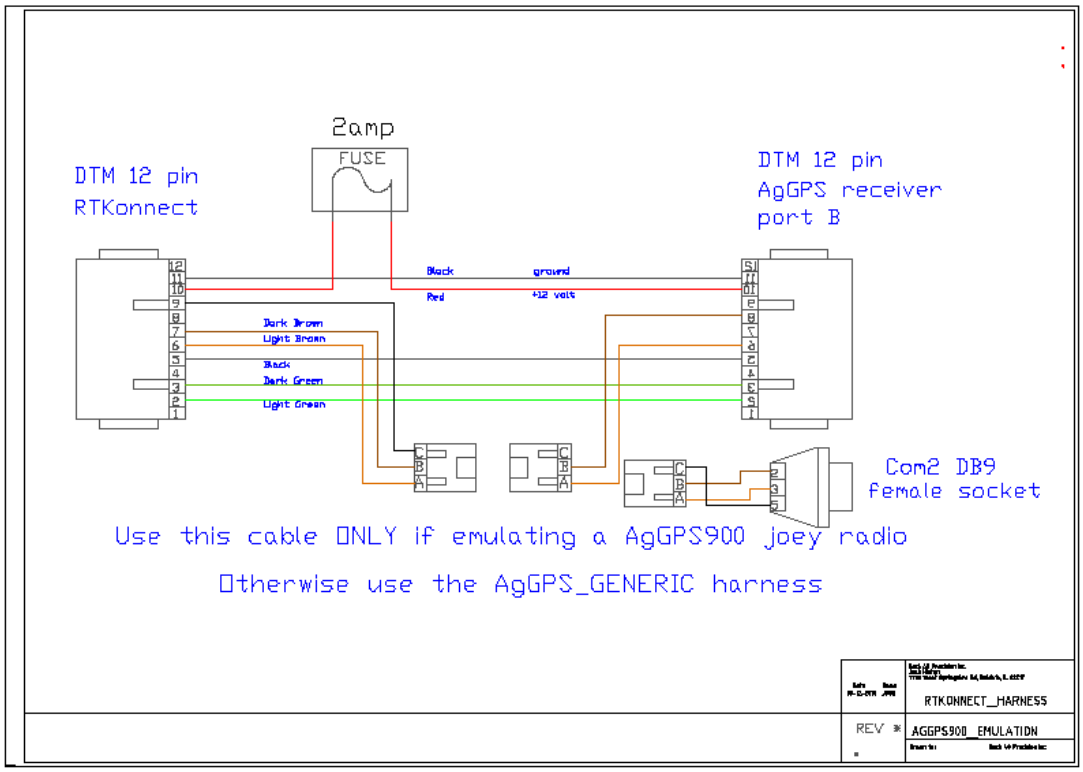

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