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# *Foreword*

## *Scope of this manual*

This manual contains the specifications, functional description, operating instructions, schematic, parts locator and parts list for the 2018 CentryII® GPS/AVL unit.

This manual is intended for use by qualified service technicians to aid them with installation, interfacing, alignment and trouble shooting of the CentryII®.

## *Service manual revisions*

Component changes, additions and deletions may occur in the circuit design to improve operation and will be reflected in future releases of this service manual. Specifications and circuit changes are subject to change without prior notice or obligation by Pyramid Communications.

## *Safety information*

The CentryII® is designed to operate within all applicable Federal regulations at the time of manufacture. Proper operation and service procedures will assure continued compliance with these regulations:

- ⚡ Do not operate the CentryII® in the presence of unshielded electrical blasting caps or in an explosive environment.
- ⚡ Do not operate the CentryII® while refueling the vehicle or in the presence of explosive fumes.
- ⚡ All persons must be at least 20cm from antenna when transmitter is operating to meet FCC RF exposure requirements.

# Specifications

## General:

Indicators: 7 high brightness LED's  
Storage: 1024 position fixes. Non-volatile E<sup>2</sup>PROM with 100 year data retention.  
Interface: *Power and General Purpose IO:* DB9M  
*PC Programming:* DB9F Bidirectional 9600 baud N81  
*In-Car mapping/KDS-100 MDT:* DB9F Bidirectional 9600 baud N81  
*GPS Antenna:* SMA female  
*Transceiver antenna:* TNC female

## Power Requirements:

DC Supply 13.6VDC negative ground  $\pm 10\%$ . 200 mA nominal, 3A peak transmit

## Physical:

Dimensions: 8.00"L x 6.00"W x 2.25"H  
Weight: 30 oz.  
Case: Extruded Aluminium

## Transmitter:

Frequency: 806-821 MHz  
Power: 600mW nominal  
Modulation: 4/16/64 QAM 20K0D7W  
Stability: .2ppm (locked to base)  
Spurious: -43dBW  
Adj channel Pwr: -60dB @  $\pm 25$ kHz  
FCC ID: AZ489FT5796

## Receiver:

Frequency: 851-866 MHz  
Sensitivity: -111dBm @ -10%BER  
Selectivity: 60dB @  $\pm 25$ kHz  
Image rejection: 55dB

## GPS:

Channels: 16  
Frequency: 1575 MHz  
Output: NMEA-0183 v2.1 RMC  
Antenna: Active LNA 5V @ 20mA

## Inputs/Outputs:

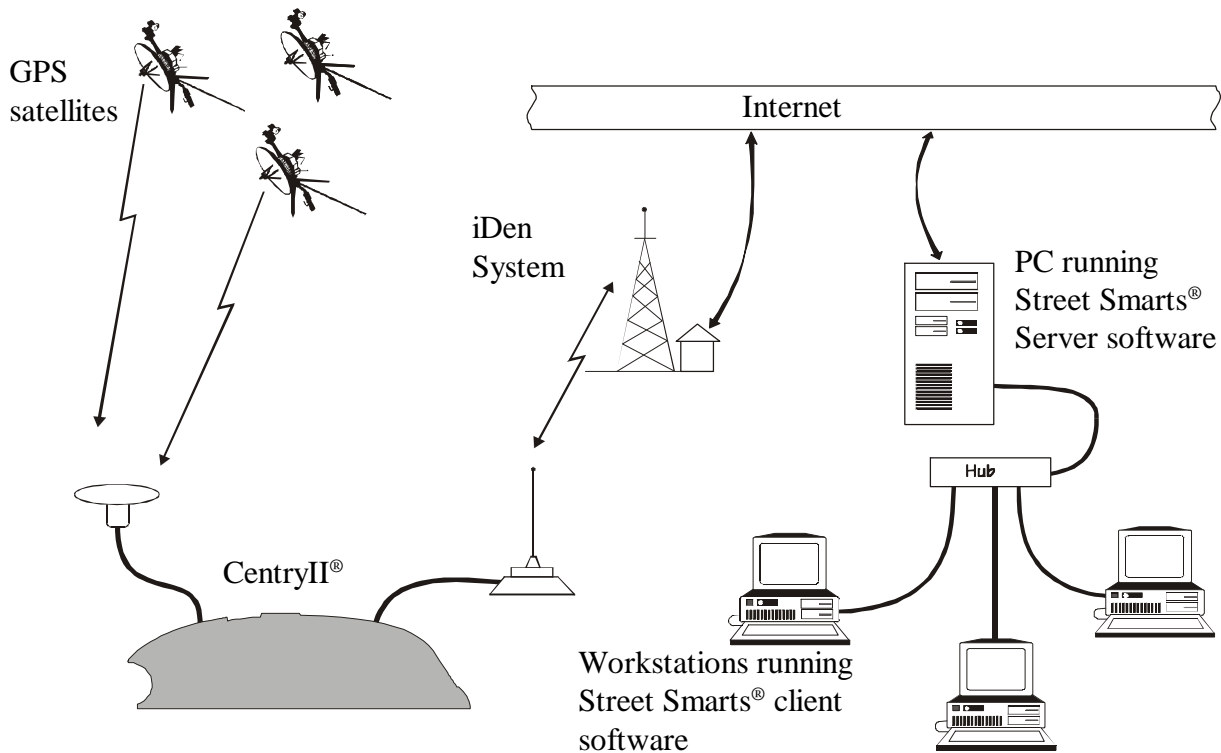
Aux1-3 In: Active Low 0-12VDC max  
Aux1-3 Out: Active Low 2A open drain latching

## Mil-Std-810D/E:

501.2	Procedure II	High Temp +60°C
502.3	Procedure II	Low Temp -30°C
514.3	Procedure I Cat. 8	Vibration Ground Vehicle
516.3	Procedure I	Shock

## Functional Description

The CentryII® series AVL from Pyramid Communications is a microprocessor controlled GPS Automatic Vehicle Location device that contains a built in iDen transceiver. Data is sent over a wireless network and the internet, and requires activation on an iDen system such as Nextel® or Southern Linc.



The unit will automatically send its position information to dispatch on a pre-programmed interval. The CentryII® AVL has 3 inputs that can be used for general purpose vehicle monitoring (doors open, shotgun removed, etc.) or can be programmed for special functions. The AVL also has 3 general purpose outputs that can be used to alert the driver when out of the vehicle or for remote control of vehicle functions. Position updates are stored in non-volatile E<sup>2</sup>PROM memory for download and playback at a later time. The CentryII® is capable of storing 85 hours of vehicular activity at 5 minute update intervals.

The CentryII® has an interface connector that allows GPS mapping data to be sent directly to a laptop running Street Light® mapping software for in-car tracking and routing capabilities. The connector alternately allows the CentryII® to interface directly with a KDS-100 mobile data terminal to provide status and text messaging capabilities. The two functions are mutually exclusive: *the CentryII® cannot be connected to a PC and a KDS-100 at the same time.*

The CentryII® is PC programmable for all operating parameters through the serial interface jack on the side panel using a standard DB9M-F cable. See page 10 for programming details.

**GPS Reporting:** The CentryII® AVL will automatically send its position information on a pre-programmed interval. One of the general purpose inputs can be programmed as a Code 3 input. When active, the AVL will update at a shorter interval for more accurate tracking by dispatch. Both update rates are PC programmable. Normal Rate can be programmed between 1 minute and 4 hours in one minute increments. Code 3 rate can be programmed between 5 seconds and 4 minutes in 1 second increments.

The CentryII® AVL also monitors the vehicle speed and heading in real time and can report its position anytime the vehicle moves, stops, turns or speeds. Each of these capabilities can be enabled or disabled in programming.

Each position update is automatically stored in non-volatile E<sup>2</sup>PROM memory for later recall and playback. The CentryII® is able to store 1024 position fixes including date, time, speed, heading and position fix within 50 feet. The data is stored in a circular queue with the oldest data being overwritten with each new position fix. The CentryII® AVL can store 85 hours of vehicular activity at 5 minute update intervals. The 1024 position playback is accessible through the PC programming jack on the side panel of the unit.

If the vehicle drives out of radio range, the CentryII® will continue to store the position fixes on the pre-programmed interval. When the vehicle is back within range, the CentryII® will automatically send the queued position fixes (up to 25) to the dispatcher preventing gaps in the daily tracking.

Additionally, the dispatcher may poll the CentryII® AVL at anytime for its position regardless of the programmed time interval or speed of the vehicle.

**Programmable Inputs:** The CentryII® AVL has 3 general purpose inputs that can be used to monitor vehicle status such as door open, shotgun removed from holder, etc. Each input has a special function that can be enabled via PC programming. Input 1 can be programmed for **Emergency** transmission to alert dispatch in the event of a pending emergency. Input 2 can be used for **GPS on demand** that will send a position fix when ever a switch is closed and/or opened. Input 3 can be used for **Code 3** input to change the update rate between slow and fast.

**Outputs:** The CentryII® AVL has 3 general purpose high current outputs that can be used to alert the driver when out of the vehicle or for remote control of vehicle functions. Each output can be independently toggled by the dispatcher and is capable of directly driving a relay coil or any load up to 2A. All three outputs are latching, but output #1 can be programmed for a momentary horn honk feature.

# Installation

The CentryII® interface is via a DB9 cable to provide power and access the general purpose inputs and outputs as detailed below:

## P1 (DB9-M) Power Connector

- Pin 1:** Ground. Connect to the vehicle ground  
(Shield/Black)
- Pin 2:** Aux output 1, active low. General purpose output 2A open drain. Can be programmed for horn honk output (pulse 3 times for ½ second each).  
(White)
- Pin 3:** Aux output 2, active low. General purpose output 2A open drain.  
(Blue)
- Pin 4:** Aux output 3, active low. General purpose output 2A open drain.  
(Green)
- Pin 5:** Switched 13.6VDC from the vehicle. This line *must* go off when the vehicle is switched off, since the CentryII® does not have a power switch. It should be capable of supplying at least 3A.  
(Red)
- Pin 6:** Aux input 1, active low. General purpose status input with programmable function for ***Emergency*** input.  
(Yellow)
- Pin 7:** Aux input 2, active low. General purpose status input with programmable function for ***GPS on Demand***.  
(Violet)
- Pin 8:** Aux input 3, active low. General purpose status input with programmable function for ***Code 3*** update rate.  
(Brown)
- Pin 9:** Aux input 4, active low. Not supported at this time.  
(Grey)

## **P2 (DB9-F) Programming Connector DCE 9600 N81**

**Pin 1:** N/C

**Pin 2:** Transmit Data

**Pin 3:** Receive Data

**Pin 4:** N/C

**Pin 5:** Signal Ground

**Pin 6:** N/C

**Pin 7:** N/C

**Pin 8:** N/C

**Pin 9:** N/C

## **P3 (DB9-F) In-Car Mapping/KDS-100 Connector 9600 N81**

**Pin 1:** Sw B+ to KDS-100. Grounding pin 4 causes SwB+ to be activated on this pin

**Pin 2:** Transmit Data to in-car mapping PC. NMEA-0183 v2.1 RMC message. RS232 level 9600 N81

**Pin 3:** N/C

**Pin 4:** KDS-100 select input, active low. Grounding this pin switches B+ to pin 1.

**Pin 5:** Signal Ground

**Pin 6:** N/C

**Pin 7:** N/C

**Pin 8:** Transmit Data to KDS-100. TTL level 9600 N81

**Pin 9:** Receive Data from KDS-100. TTL level 9600 N81

# Operation

The CentryII® will need to be installed and activation established by a two-way radio shop or other service installation. The CentryII® requires 2 antennas, one for transmission and one for the GPS receiver. The CentryII® is powered by the vehicle's 12 volt system.

The operation of the CentryII® AVL is completely automatic. When the unit is powered up, the CPU LED should flash continuously to indicate the CPU is operating properly. The OPT LED will flash briefly until communications has been established with the internal transceiver.

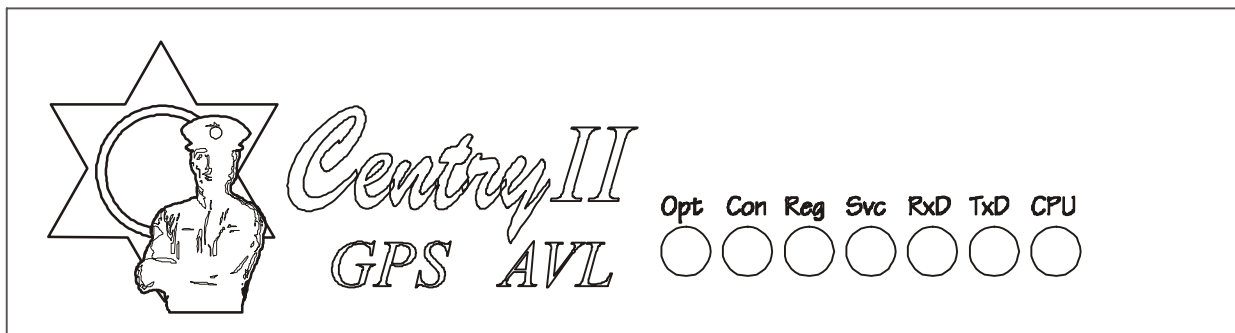
The SVC and Reg LED's will come on when local service has been identified and communications with the system established. This may take from 15-60 seconds in some cases. The CON LED will illuminate when an internet connection has been made.

The CentryII® is now operational and position information will be transmitted to the dispatcher in accordance with the internal programming.

## Front Panel Indicators

The following front panel LED's are available to indicate the various operating modes of the CentryII®:

- CPU: Flashes continuously to indicate proper operation of the CPU.
- TxD: Flashes whenever data is being transmitted.
- RxD: Flashes whenever data is being received.
- Svc: Indicates iDen service area.
- Reg: Indicates CentryII is registered in the local service area.
- Con: Indicates the CentryII has established a connection with the internet.
- Opt: Indicates optional operating modes or indicates problem if flashing.



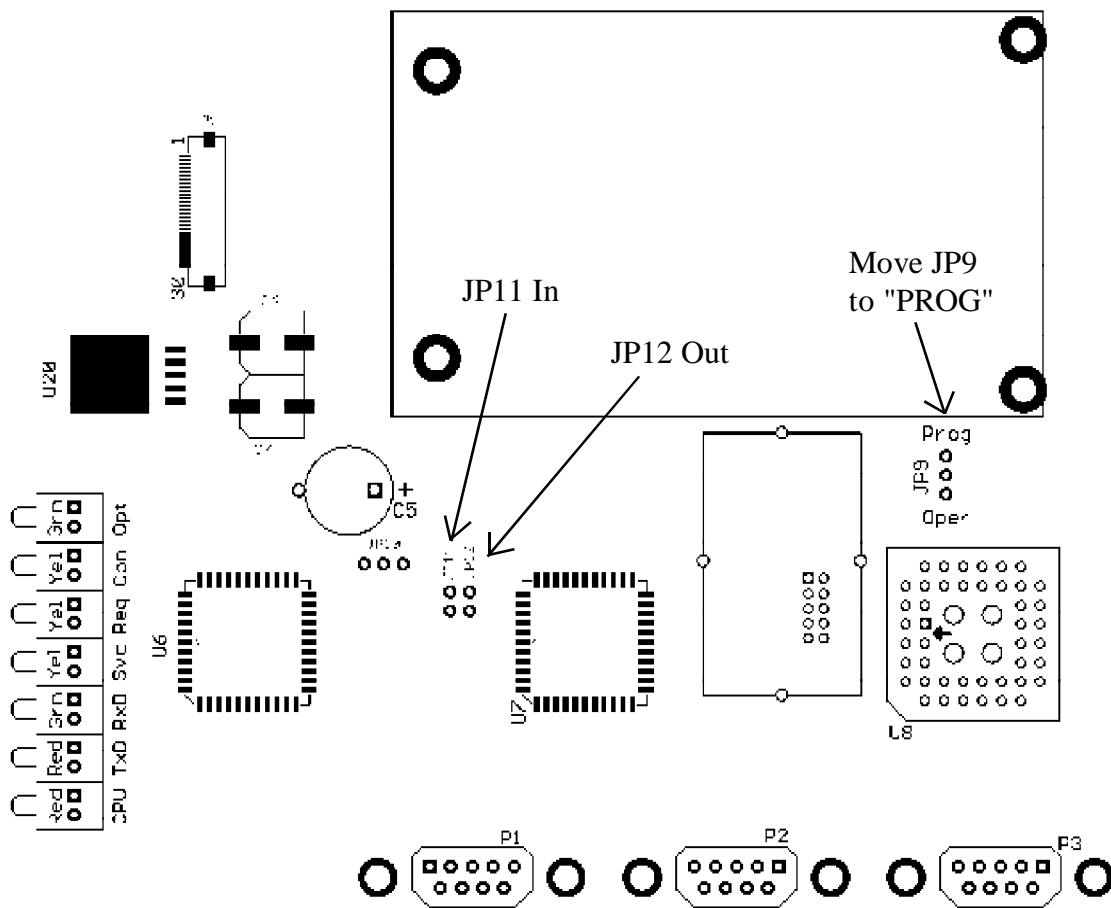
# Programming

The CentryII® is programmed using the Centry personalization software. The software will run on any PC compatible with Windows 98/2000/NT/XP equivalent.

## Important Note:

✍ Before attempting to program the CentryII® start the software and ensure the programming cable is plugged into the correct serial port. The com port may be selected under the “Transfer” menu. Plug the programming cable into P2 (center connector) on the side panel of the CentryII®.

To put the CentryII® into program mode, remove the four cap screws and slide the complete assembly out of the extrusion. Move JP9 from "OPER" to "PROG". Ensure JP11 is installed and JP12 is removed:



## Menu selections

### File

**Open:** Allows you to load a previously saved file from disk. Only files with the .CN2 extension will be loaded.

**Save:** Allows you to save the current configuration to disk. The file name entered under the common data menu is automatically inserted for file name to save. This name is also stored in the E<sup>2</sup>PROM of the CentryII® during write operations and will be the inserted file name if the radio data has just been uploaded. The program will prompt you before overwriting an existing file.

**Print:** Sends the current configuration to LPT1. Make sure the printer is on line and paper is loaded before executing this command.

**Exit:** Quits the program. You will be asked to confirm before exiting the program. The software will also prompt you if the configuration has changed since program start up and data has not been saved to disk.

### Data

**System Data:** System data controls the personality of the CentryII® and allows you to enable or disable the optional features:

File Name: stored in E<sup>2</sup>Prom and used for save operations

Vehicle #: Each vehicle must have a unique number.

Street Smarts IP Address: Dedicated IP address of the PC running Street Smarts® Server software. This can be obtained from the server software under Configure/Network Parameters. Port # should be /5250

Input/Outputs: Enables the optional features for the 3 inputs and output #1

GPS Reports: Enables GPS updates on vehicle behavior.

The screenshot shows the 'System Data' configuration window. It has a title bar with a close button. The window is divided into several sections:

- File:** A text box labeled 'File Name:' containing the text 'PYRAMID'.
- Vehicle Parameters:** A text box labeled 'Vehicle #:' containing '00100' and '00001-65534'.
- Street Smarts IP Address:** A text box containing '255.255.255.255/5250'.
- GPS Intervals:** Three rows of controls: 'GPS Slow Interval:' with a spinner set to '005' and a range of '1-255 Minutes'; 'GPS Fast Interval:' with a spinner set to '030' and a range of '5-255 Seconds'; 'History Length:' with a spinner set to '20' and a range of '1-25'.
- Inputs / Outputs:** A group box containing four checked checkboxes: 'Emergency' (next to 'Input #1'), 'GPS On Demand' (next to 'Input #2'), 'Bipolar' (next to 'Input #3'), and 'Code 3 Dual Rate'. Below these is another checked checkbox: 'Horn Honk on Output #1'.
- GPS Reports:** A group box containing four checked checkboxes: 'Vehicle Starts Moving', 'Vehicle Stops Moving', 'Vehicle Turns', and 'Vehicle Speeds'. To the right is another checked checkbox: 'GPS Updates when Vehicle is Stationary'. Below these is a 'Speeding Threshold:' spinner set to '60' with a range of '10-99 MPH', and a 'GPS Interval while speeding:' spinner set to '015' with a range of '5-255 Seconds'.

On the right side of the window are 'OK' and 'Cancel' buttons. Arrows from the text on the left point to the corresponding fields in the window.

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File Name	Up to 8 characters (upper case) that is stored in E <sup>2</sup> PROM and used for file save operations.
Vehicle Number	Identifies each vehicle in a fleet and must be a unique number for each vehicle. Range is 1-65534.
Server IP Address	The CentryII® communicates with dispatch over an iDen network and the internet. The dispatch location must be running Street Smarts® Server software which must be connected to the internet via a static IP address (non-dial up). The connection must be direct, without address translation (NAT) or through a firewall. This address must be programmed into each CentryII® on the system and will be the same in each unit. The address can be obtained from the Street Smarts® server software under the <b>Configure/Network</b> Parameters menu. The address consists of a 12 digit number, separated by periods and a port number separated by a forward slash. The port number should be set to 5250.
GPS Slow Interval	If Input #3 is high, or is not programmed for Dual Rate, the CentryII® will report it's position based on this interval. Range is 1-255 minutes.
GPS Fast Interval	If Input #3 is low and is programmed for Dual Rate, the CentryII® will report it's position based on this interval. Range is 5-255 seconds in 1 second increments.
History Length	The number of GPS messages that will be sent when a history request is received from dispatch. Also, the max number of GPS messages that will be stored and sent using auto history feature.
Emergency Input	Input #1 can be programmed for <b>Emergency</b> input. When this line is brought low, the CentryII® will send an Emergency message to the base.
GPS on Demand	Input #2 can be programmed for <b>GPS on demand</b> . When this line is brought low, the CentryII® will send its GPS position once.
Bipolar	If enabled, <b>GPS on demand</b> will also be sent when input #2 is brought high. If disabled, only grounding input #2 causes transmission.
Code 3 Dual Rate	Input #3 can be programmed for <b>Code 3</b> input. When this line is brought low, the CentryII® will report it's GPS position using the fast interval.
Horn Honk Output #1	The 3 outputs are normally latching. If enabled, the CentryII® will accept a horn honk sequence from the dispatcher and honk the vehicle horn 3 times to alert the driver who is out of their vehicle. If disabled, the CentryII® will send a Negative Ack in response to a horn honk sequence. <i>This parameter applies only to output #1.</i>
GPS on Moving	If enabled, the CentryII® will send a GPS report whenever the vehicle starts moving.
GPS on Stops	If enabled, the CentryII® will send a GPS report whenever the vehicle stops moving.
GPS on Turns	If enabled, the CentryII® will send a single GPS report when the vehicle turns a corner.
GPS on Speeding	If enabled, the CentryII® will send a GPS report when the vehicle exceeds the preprogrammed speed limit and use the speeding interval as the timed interval.
GPS on Stationary Vehicle	If enabled, the CentryII® will continue to send GPS reports on the timed interval even if the vehicle is not moving. If disabled, the CentryII® will only report its position once unless the vehicle starts moving again.
Speed Threshold	If GPS on Speeding is enabled, this sets the speeding threshold. Range is 10-100 mph.
Speeding Interval	If GPS on Speeding is enabled, this will be the update rate while the vehicle is speeding.

## ***Transfer***

***Send:*** Uploads the current configuration to the CentryII®. The program will prompt you to make the cable connection and click on OK to begin downloading.

***Receive:*** Downloads the current data from the CentryII®. The program will prompt you to make the cable connection and click on OK to begin uploading.

***Download History:*** Downloads the 1024 GPS position fixes from the CentryII®. Select the file name to save the data to; the program will prompt you to make the connection to the programming jack on the side panel of the unit and click on OK to begin uploading. Transfer takes approximately 2 minutes. You can abort the process by pressing Cancel at any time.

***Com Port.*** Selects which com port the program uses to communicate with the CentryII®. Select 1-4.

## ***Help***

You can click on the Help Icon at anytime. Context sensitive help will be determined by which data item has focus.

## ***Notes***

# Theory of Operation

## General

All of the functions of the CentryII® are under control of the microprocessors U6-U8 which also contain the firmware operating system and interface to the rest of the hardware. Non-volatile data storage is contained in U13 for the CentryII® personality data and in U9-U12 for GPS position recording.

## Logic Control

U6 is the primary  $\mu$ P and communicates with the Nextel IO1500 module. U7 is the first slave  $\mu$ P and communicates with the GPS module and the PC when in program mode. U8 is the second slave  $\mu$ P and communicates with the KDS-100 and buffers the data to and from the master  $\mu$ P U6. U6 communicates with U7 and U8 over a high speed 5 wire SPI interface. JP9 puts the CentryII® into program mode or normal operate mode.

## Serial Interface

P2 is the serial interface between a PC and the CentryII®. Jumpers J11 and J12 determine which device the PC is connected to according to the following chart:

	JP12	JP11
$\mu$ P U6	Out	Out
$\mu$ P U7	Out	In
IO1500	In	Out
GPS	In	In

For normal operation, ensure JP11 is installed and JP12 is removed.

## LED Displays

All of the front panel LED's are controlled by  $\mu$ P U6 with the exception of TxD and RxD which are controlled directly by the hardware. TxD will illuminate anytime data is being sent from the CentryII® to the PC regardless of the source. RxD will illuminate anytime data is being received from the PC regardless of the destination. Surface mount LED's D14-D17 indicate serial data transfer between U7 and the GPS module or U8 and the KDS-100.

D18 and D19 reflect the operating status of the IO1500:

Red LED on constant	IO1500 is not registered with the local system
Red & Green Blinking	IO1500 attempting registration
Green LED Blinking	IO1500 in service area and registered

D20-D22 are status indicators on  $\mu$ P U7 which monitors the GPS position information. Indications are for Speeding, Turning and Moving respectively.

## Memory Retention

U13 E<sup>2</sup>PROM provides data retention of programming information. The E<sup>2</sup>PROM has a data retention of up to 100 years without power applied. U13 communicates with the microprocessor on lines SCL and SDA.

U9-U12 provide the non-volatile storage for the GPS position data. The microprocessor communicates with the serial E<sup>2</sup>PROMs via a two wire interface SCL and SDA

## PC/KDS-100 Interface

P3 interfaces with a PC for in-car GPS monitoring and routing, or alternately with a KDS-100 MDT. Pin 4 of P3 selects the KDS-100 interface (low) or communications with a PC (high). Grounding pin 4 also switches B+ to pin 1 of P3 to power the KDS-100.

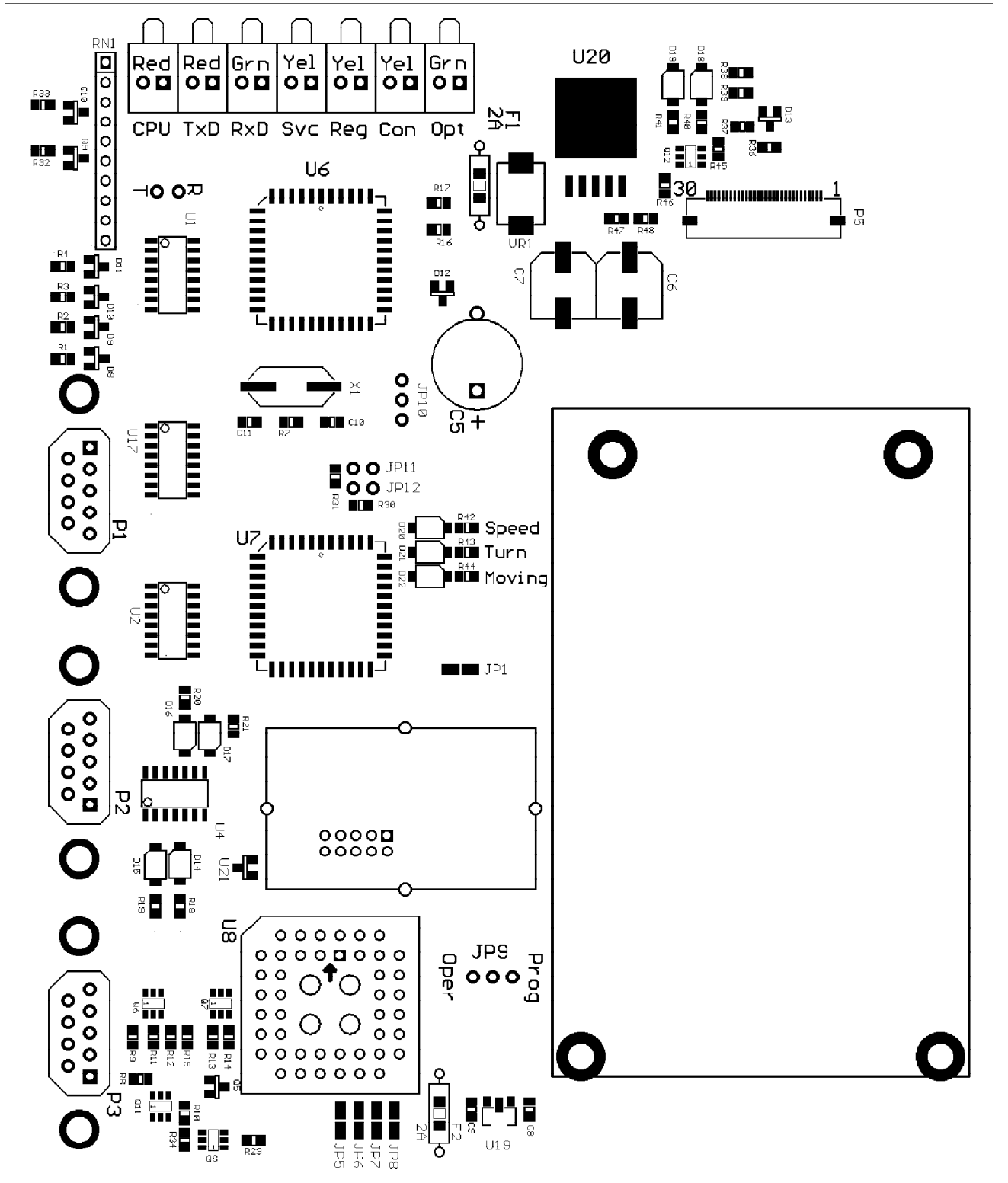
## Parts List

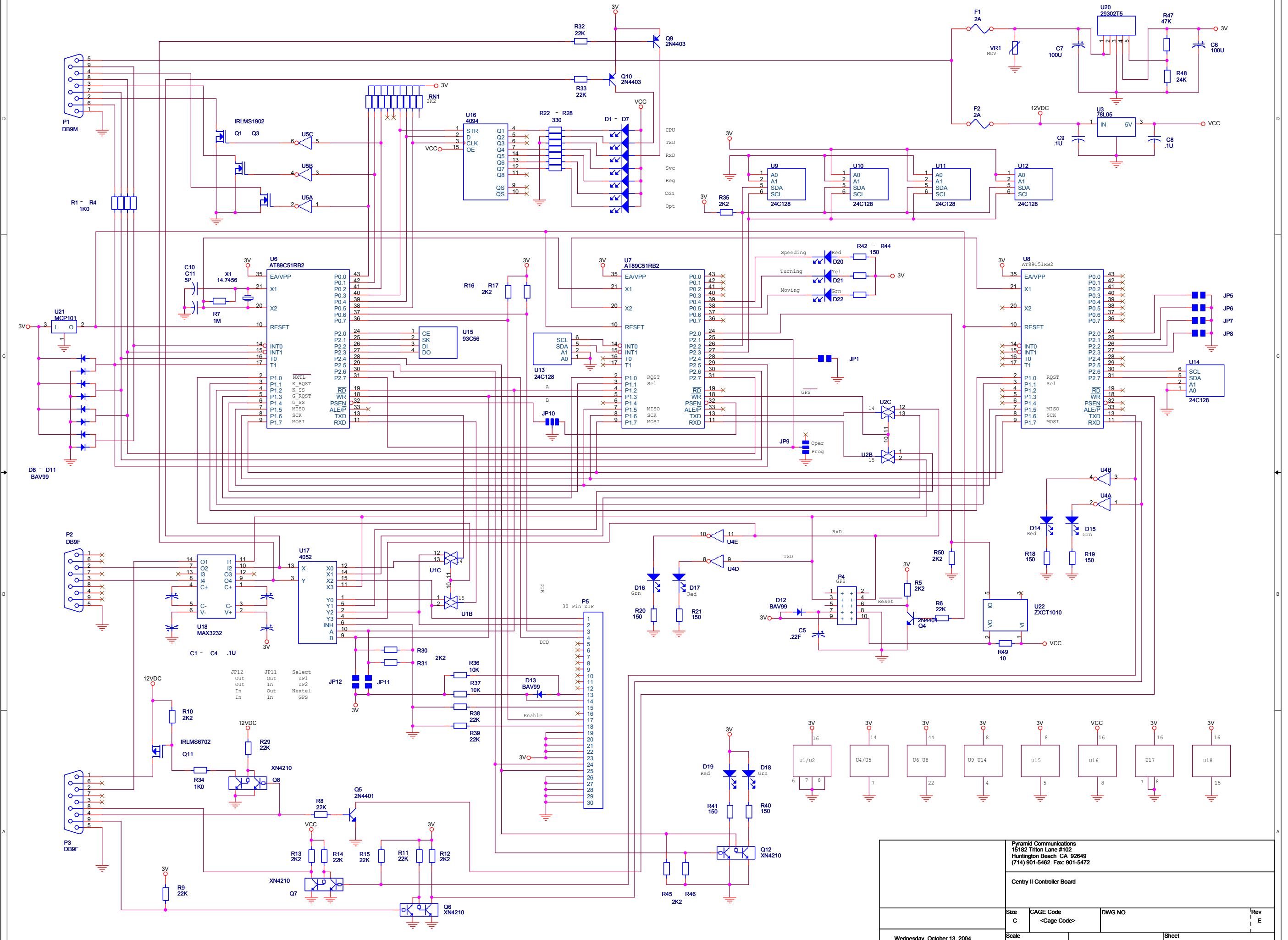
Reference	Description	Part #
C10,C11	5 pfd 0805 chip cap	1010-03-5509
C1,C2,C3,C4,C8,C9	0.1 µfd 0805 chip cap	1010-03-5104
C6,C7	100 µfd SMT electrolytic	1410-09-6107
C5	0.22 Farad electrolytic	1481-18-5229
D1,D2	Red LED	4001-01-2501
D4,D5,D6	Yellow LED	4001-01-2503
D3,D7	Green LED	4001-01-2502
D8-D13	BAV99 Dual diode sot-23	3110-01-0099
D14,D17,D19,D20	Red LED SMT	4010-01-0502
D15,D16,D18,D22	Green LED SMT	4010-01-0505
D21	Yellow LED SMT	4010-01-0281
F1,F2	Fuse, 2A	2610-04-0020
JP9, JP10	3 pin .100" header	7300-53-0103
JP11,JP12	2 pin .100" header	7300-53-0102
P1	DB9-M Connector	7409-00-0010
P2,P3	DB9-F Connector	7401-00-0010
P5	0.5mm 30 pin ZIF	7200-05-0130
Q1-Q3	IRLMS1902 MOSFET	3310-01-1902
Q4, Q5	2N4401 npn sot-23	3010-01-4401
Q6-Q8, Q12	XN4210 dual npn	3010-03-4210
Q9,Q10	2N4403 pnp sot-23	3010-01-4403
Q11	IRLMS6702 MOSFET P chan	3310-01-6702
RN1	2.2 K Resistor network	2002-07-5222
R1-R4, R34	1K 0805 chip resistor	2010-03-5102
R7	1M 0805 chip resistor	2010-03-5105
R6,R8,R9,R11,R14,R15,R29,R32,R33,R38,R39	22K 0805 chip resistor	2010-03-5223
R47	47K 0805 chip resistor	2010-03-5473
R18-R21,R23,R24,R40-R44	150 Ohm 0805 chip resistor	2010-03-5151
R5,R10,R12,R13,R16,R17,R30,R31,R35,R45,R46,R50	2.2K 0805 chip resistor	2010-03-5222
R22,R25-R28	330 Ohm 0805 chip resistor	2010-03-5331
R36,R37	10K 0805 chip resistor	2010-03-5103
R48	24K 0805 chip resistor	2010-03-5243
R49	10 Ohm 0805 chip resistor	2010-03-5100
U1,U2	4053 Analog Mux	3410-01-4053
U3	LM78L05 100mA 5V regulator	3410-10-7805
U4,U5	74C14 Hex inverter	3510-01-7414
U6,U7,U8	AT89C51RB2 µP	3611-02-8951
U9-U14	Serial E <sup>2</sup> PROM 24C128	3610-01-4128
U15	Serial E <sup>2</sup> PROM 93C56	3610-01-9356
U16	4094 Shift Register	3510-01-4094
U17	4052 Analog Mux	3410-01-4052
U18	MAX3232 RS232 Driver	3410-01-3232
U20	3A Adjustable regulator	3410-14-9302
U21	3.3V reset controller	3410-11-0300
U22	High side current monitor	3410-12-1010

VR1 .....	MOV Surge protector 18V .....	2510-06-0018
X1 .....	14.7456 MHz Crystal .....	6010-01-1474

***Mechanical Assembly***

16 channel GPS Receiver .....	9900-16-8015
iDen IO1500 module .....	9205-09-1500
0.5 mm flex cable .....	7504-02-0530
TNC-MMCX cable assembly .....	7504-07-0718
Extruded aluminium case .....	8100-01-2018
Aluminium end panel blank .....	8200-04-2018
Aluminium end panel connectors .....	8201-04-2018
10ft. power cable with DB-9F conn. ...	7500-10-1001
4-40 x 3/8" SS cap screw .....	8000-34-4406
2-56 x 1/4" Standoff .....	8000-65-2564
2-56 x 3/16" SS philips .....	8000-24-2563





Pyramid Communications 15182 Trilon Lane #102 Huntington Beach CA 92649 (714) 901-5462 Fax: 901-5472			
Centry II Controller Board			
Size C	CAGE Code <Cage Code>	DWG NO	Rev E
Scale		Sheet 1	of 1

Wednesday, October 13, 2004