WunderBot III

Function Block Diagrams

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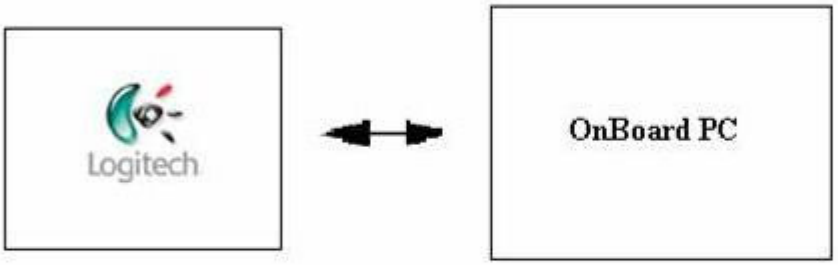
Logitech QuickCam Pro 4000
Connection to OnBoard PC by USB port
Used to stream-live video from the Wunderbot onto the internet



Product Specifications

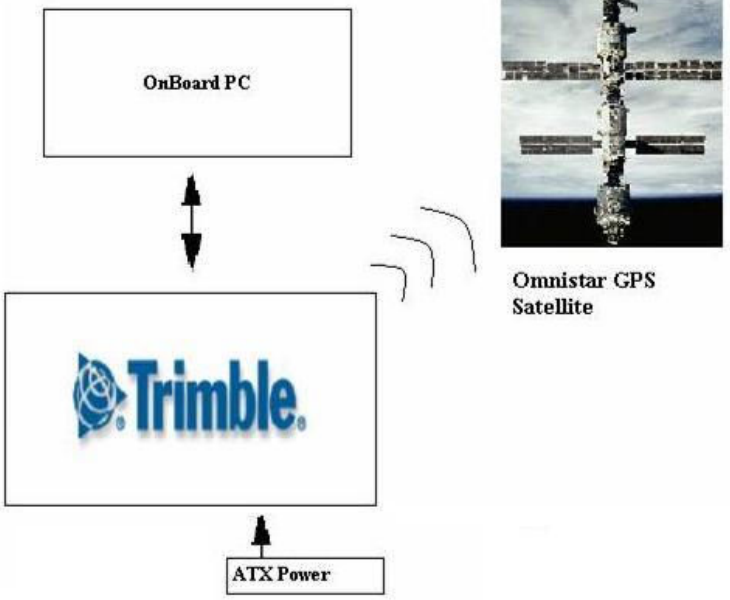
* **Video capture: Up to 640 x 480 pixels (VGA CCD)**
* **Still image capture: Up to 1280 x 960 pixels, 1.3 megapixels (software interpolated)**
* **Frame rate: Up to 30 frames per second**
* **Shoot 1.3 megapixel (software interpolated) photos and high-quality videos**
* **Hear live audio with the built-in microphone**

Trimble AgGPS114
Real-Time DGPS Smart Antenna

General:	12 channel L1 code phase receiver
Update Rate:	1 Hz Standard; 10 Hz Optional
Position Accuracy:	sub-meter differential
Time to First Fix:	<30 sec, typical
NMEA Messages:	GGA, GLL, GRS, GST, VTG, RMC, GSA, GSV, XTE, ZDA, ALM, MSS
Communication ports:	2 ea. RS-232, 1 ea. J1939 (CAN 2.0B)
Weight:	22 oz. (0.52 kg)
Power:	3.1 W, 9 to 32 volts
Operating Temp:	-30°C to +60°C (-22F to +140F)
Storage Temp:	-40°C to +80°C (-40F to +176F)
Humidity:	100% condensing
Casing:	UV-resistant Plastic 6 in. D X 5 in. H (152 mm D X 127 mm H)
Compliance:	FCC Class B, CE, EP 455

STANDARD FEATURES

- Completely self-contained in a tough plastic housing
- 12-channel DGPS receiver
- Positioning based on high-performance GPS engine design
- Internal L-band satellite differential receiver
- World-wide operation with both Omnistar and Racal subscriptions
- External RTCM correction input
- Sub-meter differential accuracy
- Two programmable RS-232 serial ports
- CAN bus J1939 compatible
- 1-PPS output
- Outputs GPS position in either NMEA or TSIP data messages
- Configuration software
- Magnetic mount
- Remote Display Interface (RDI) software for Windows 95/98
- WAAS/EGNOS upgradable
- *Ag*GPS 170 Field Computer compatible
- *Ag*GPS 70 Remote Display and Logger compatible



RS-232 serial communication transmits and receives information and instructions between the onboard PC and "Differential" GPS

The Trimble AgGPS 114, a differential GPS receiver, offers positional output accurate within 30 centimeters. Important information about location, speed, and distance is interpreted from GPS data.

Full Data Sheets for Trimble GPS114 are located in the downloads page of the Wunderbot 3 website.

PNI TCM2-50 Digital Compass

Patented Magneto-Inductive Sensors
The magnetic sensors in the TCM2 use PNI's patented technology, providing superior accuracy and lower power consumption compared to Flux Gate or Magneto-Resistive sensors.

Electronic Gimbaling
Provides accurate and reliable compass readings up to ±50° tilt. Unlike mechanically gimballed 2-axis fluxgate compasses, the magnetic sensors' orientations are fixed relative to magnetic distortion sources for superior accuracy in all conditions.

Accurate in any environment
Advanced electronics and built in algorithms counter the effects of hard iron interference.

Heading Information
Accuracy when level: 1.0° RMS
Accuracy when tilted: 1.5° RMS
Resolution: 0.1°
Repeatability: ±0.3°

Tilt Information
Accuracy: ±0.4°
Resolution:0.3°
Repeatability: ±0.3°
Range: ±50°

The TCM2-50 is at the End of Life do to obsolete components. Inventory is available to support current customers, however it is limited. Please contact us to discuss how to transition to a new version of the TCM module.

The TCM2-50 precision 3-Axis orientation sensing instrument provides:
-Tilt compensated compass heading (also known as azimuth, yaw, or bearing angle). The heading is accurate even when tilted up to ±50° due to precise electronic gimbaling or tilt compensation.
-Built in calibration to correct compass heading when near magnetic sources and magnetic materials, known as Hard Iron calibration.
-Precise tilt angles relative to Earth's gravity, known as the pitch and roll angle. Pitch angle is also known as elevation or dive angle. The roll angle is sometimes also called the bank angle.
-Temperature measured in °F or °C.
-Calibrated or uncalibrated magnetic field intensity in 3 dimensions.

Data is output on a standard RS-232 serial interface with a simple text protocol that includes checksums for superior data integrity.

Power Requirements
Supply Voltage:
 # +5 VDC regulated or 6 to 18 VDC unregulated

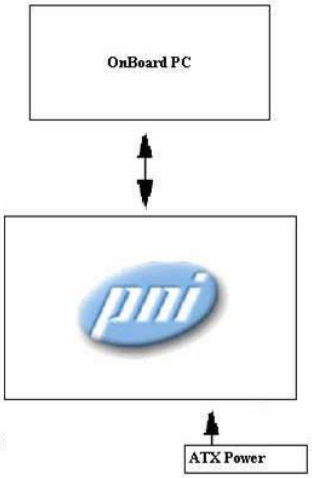
Current Draw:
 # Standard Mode: 15-20 mA
 # Low Power Mode: 7-13 mA
 # Sleep Mode: 2.5 mA

Operating Temperature
-20° to +70° C

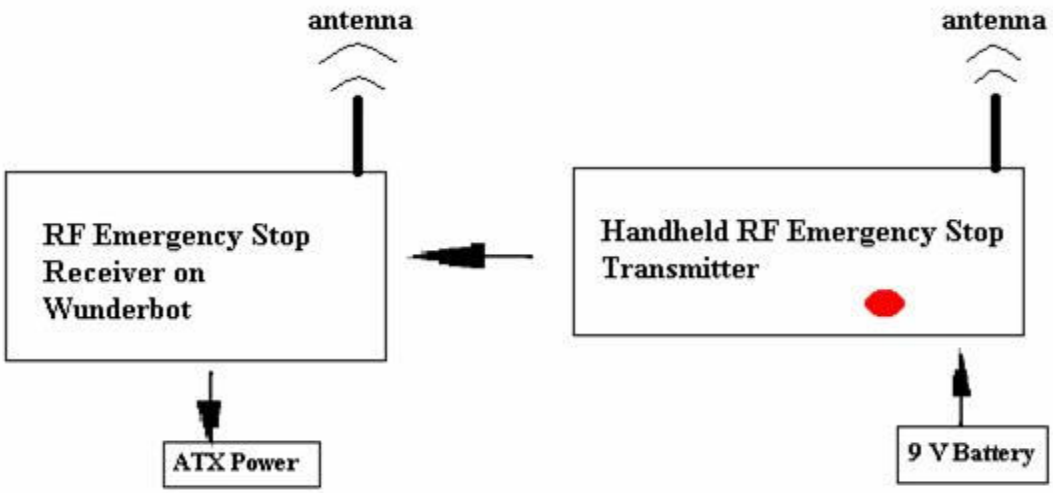
Interfaces
 # DIGITAL: RS232C
 # NMEA0183
 # ANALOG: 0-5 V Linear, 19.53mV resolution (256 discrete levels)
 # 0-5 V quadrature (sine and cosine)

Dimensions
63.5 x 50.8 x 31.75 mm

Weight
45.5 grams

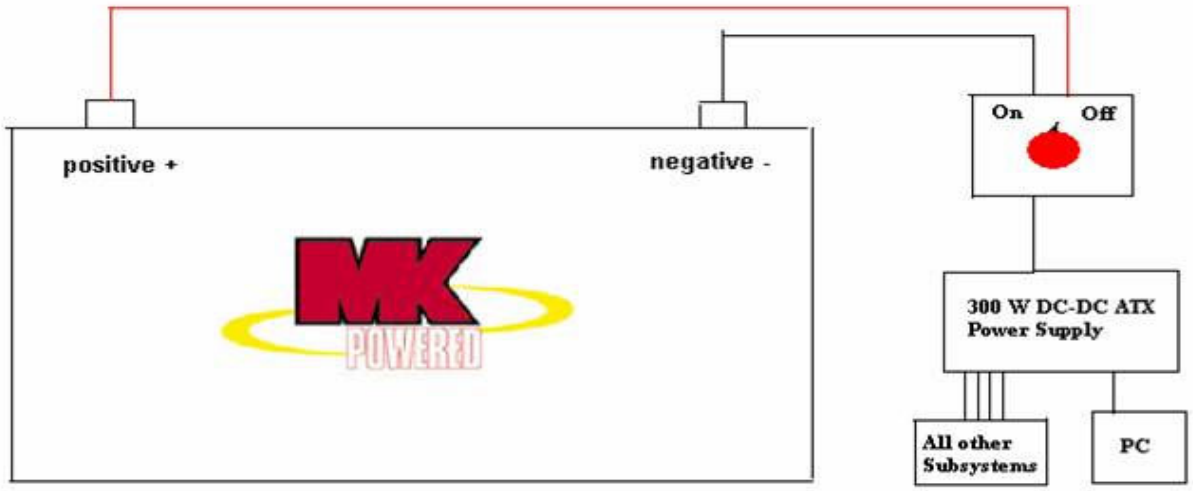


Full Data Sheets for PNI Digital Compass are located in the downloads section of the Wunderbot 3 website, under TCM2-50



The Emergency Stop System includes an Handheld RF Emergency Stop Transmitter with a red push button and a RF remote stop receiver.

The RF receiver board controls a power relay, which is placed parallel between the control line of the motor controller and ground. When the E-stop transmitter red button is pressed a signal is sent to the receiver then a relay is tripped, the control line is shorted, the motors are halted, and the motor controller shuts off immediately. This system was thoroughly tested and has proven to be reliable.



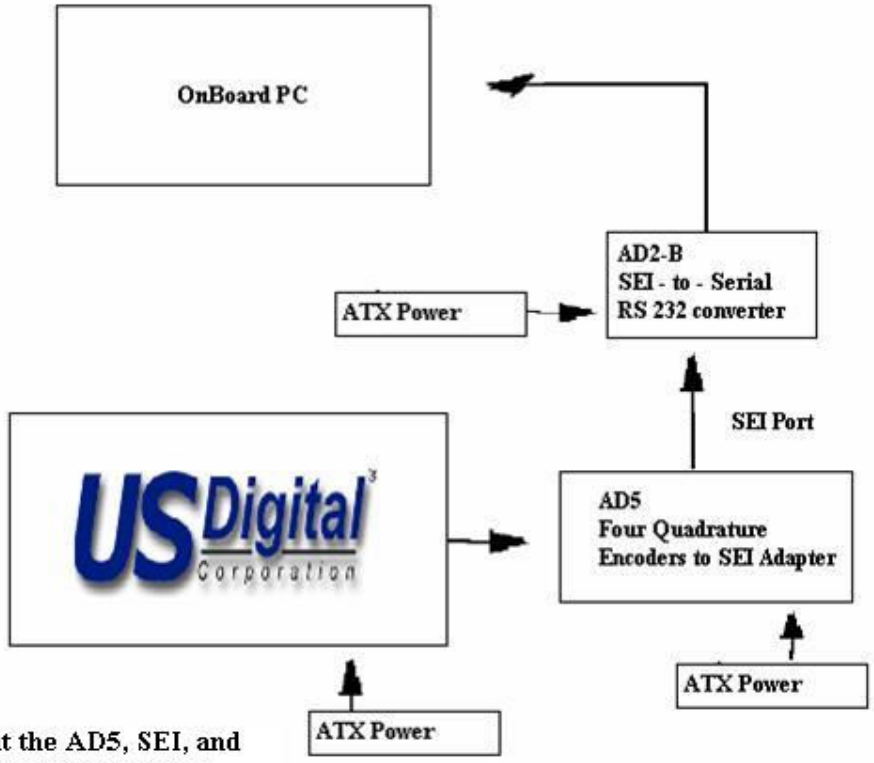
Two 12V 60-amp hour batteries connected in series, provides approximately two hours of operating time. A 300W 24V DC-DC ATX power supply provides voltage regulation for the onboard PC and all system components.

US Digital Optical Encoders

Data flows from optical encoders which are attached to the drive-shaft of the motor. There is a plate that has small notches in it, that an optical light counts the ticks as the motor spins the wheels. These ticks are about 100 counts per revolution, which with the tire size gives us an extremely accurate measurement for our position.

From the optical encoders information moves onto the AD5, which can handle up to 4 optical encoders at a given time. This speeds up the counting from the encoders at a maximum rate of 2 Mhz. Also it uses baud rates of 115K baud and has digital filtering of signals.

From the AD5 the information leaves through the SEI port, which in use with the AD2-B platform which makes everything easy to transform into serial RS232 to connect straight to the OnBoard PC. AD2-B is the standard 9 pin serial port.



Do to large quantity of information about the AD5, SEI, and AD2-B, the full data sheets and data communications for each piece of equipment that is depicted in the above block diagram could be found in the Downloads section of the Wunderbot 3 website under US Digital Optical Encoders.

RobotEQ AX2550 motor controller

Fully Digital, Microcontroller-based Design

- Multiple operating modes
- Fully programmable using either built-in switches and 7 segment display or through connection to a PC
- Non-volatile storage of user configurable settings. No jumpers needed
- Simple operation
- Software upgradable with new features

Multiple Command Modes

- Radio-Control Pulse-Width input
- Serial port (RS-232) input
- 0-5V Analog Command input

Multiple Advanced Motor Control Modes

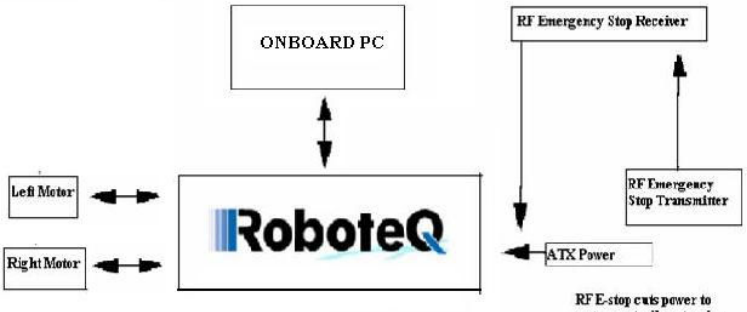
- Independent operation on each channel
- Mixed control (sum and difference) for tank-like steering
- Open Loop or Closed Loop Speed mode
- Position control mode for building high power position servos
- Modes selectable independently for each channel

Automatic Joystick Command Corrections

- Joystick min, max and center calibration
- Selectable deadband width
- Selectable exponentiation factors for each joystick
- 3rd R/C channel input for weapon and accessory output activation

Special Function Inputs/Outputs

- 2 Analog inputs. Used as
  - •Tachometer inputs for closed loop speed control
  - •Potentiometer input for position (servo mode)
  - •Motor temperature sensor inputs
  - •Battery voltage sensor
  - •User defined purpose (RS232 mode only)
- One Switch input configurable as
  - •Emergency stop command
  - •Reversing commands when running vehicle inverted
  - •General purpose digital input
- Up to 2 general purpose outputs for accessories or weapon
  - •One 24V, 2A output
  - •One low-level digital output
- Up to 2 general purpose digital inputs



Internal Sensors

- Voltage sensor for monitoring the main 12 to 40V battery system operation
- Voltage monitoring of internal 12V
- Temperature sensors on the heat sink of each power output stage
- Sensor information readable via RS232 port

Low Power Consumption

- On board DC/DC converter for single 12 to 40V battery system operation
- Optional 12V backup power input for powering safely the controller if the motor batteries are discharged
- Max 200mA at 12V or 100mA at 24V idle current consumption
- Power Control wire for turning On or Off the controller from external microcomputer or switch
- No power consumed by output stage when motors are stopped
- Regulated 5V output for powering R/C radio. Eliminates the need for separate R/C battery

High Efficiency Motor Power Outputs

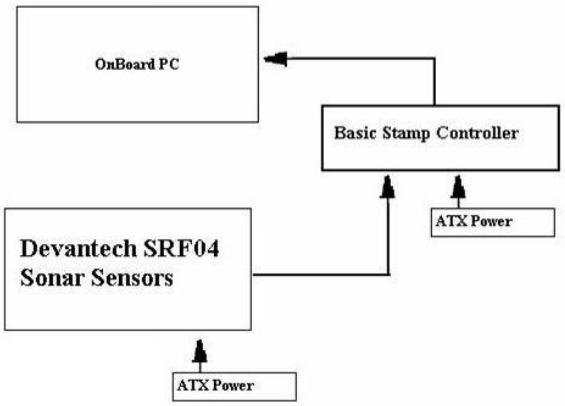
- Two independent power output stages
- Dual H bridge for full forward/reverse operation
- Ultra-efficient 2.5 mOhm ON resistance (RDSon) MOSFET transistors
- 12 to 40 V operation
- High current 8 AWG cable sets for each power stages
- SmartAmps Automatic current limitation based on actually measured transistor temperature.
  - •120A up to 15 seconds (per channel)
  - •100A up to 30 seconds
  - •80A extended
  - •High current operation may be extended with forced cooling
- 250A peak Amps per channel
- 16kHz Pulse Width Modulation (PWM) output
- Auxiliary output for brake or clutch
- Heat sink extruded case

Full Data Sheets for RoboteQ motor controller found in the downloads section of the Wunderbot 3 webpage.

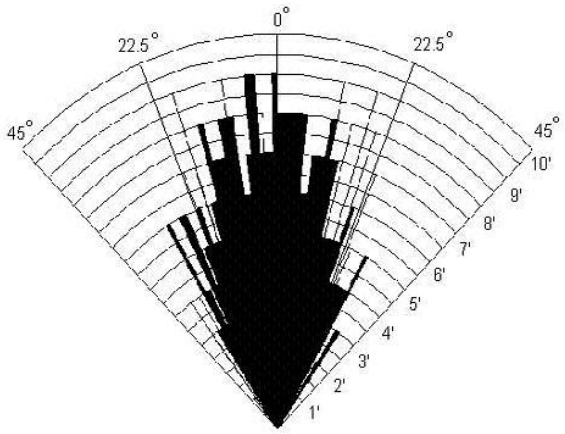
Devantech SRF04 Sonar Sensors

RS-232 serial communication transmits and receives information and instructions between the onboard PC and basic stamp which has the data from the Sonar Sensors.

These particular sonar sensors have the ability to detech objects up to 13 feet away. In testing in past years we have detected objects from 8 feet away. A basic stamp operates each device and relays data via serial link to the onboard computer.



Specifications

Beam Pattern	see below
Voltage	5v
Current	30mA Typ. 50mA Max
Frequency	40KHz
Maximum Range	3 m
Minimum Range	3 cm
Sensitivity	Detect a 3cm diameter stick at > 2 m
Input Trigger	10uS Min. TTL level pulse
Echo Pulse	Positive TTL level signal, width proportional to range.
Weight	0.4 oz.
Size	1.75" w x 0.625" h x 0.5" d

Beam Pattern