

## BTC-88 Pan and Tilt Gimbal



Figure 1 Procerus partner, Brandebury Tool, is the maker of the BTC-88 Fully Retractable Pan and Tilt Gimbal ([www.microuav.com](http://www.microuav.com)).

### FEATURES

- Fully retractable camera dome
- Pan and Tilt Camera (360 and 90 degrees respectively)
- Direct-drive tilt gear.
- Stainless steel pan chain drive with carbon fiber sprockets
- Carbon fiber, molded plastic, and aluminum construction
- Sealed ball bearings
- Pulse Width Modulation (PWM) control of servos
- Zoom: 40x (Optical Zoom: 10x Digital Zoom: 4x)
- Supported by OnPoint™ Targeting with Virtual Cockpit™
- Image Stabilization through OnPoint™ Targeting
- Light Weight: 220 grams (Including camera) (335g retractable)
- Dimensions: 4.5" x 3.5" x 3.5"
- Ball Diameter: 88mm (3.5")

### APPLICATIONS

- Persistent Imaging of an Area or Target
- Image Based Target Localization and Navigation
- Search and Rescue
- Aerial Surveillance and Reconnaissance



### DESCRIPTION

The BTC-88 Micro Ball Turret Gimbal, made by Brandebury Tool, is a lightweight, full-featured, pan-and-tilt gimbal that is specifically designed for imaging onboard small UAVs. The camera dome is fully retractable and employs a metal geared servo to fully retract and lock the camera dome behind a pair of optional sliding beetle-wing doors to keep the system out of harm's way during takeoffs, landings, or when not in use.

The BTC-88 features the Sony FCB-IX camera which is controlled through a RS-232 or TTL serial port to customize camera settings and control the 10:1 optical and 4:1 digital zoom.

The chassis consists of machined polymers and carbon fiber composite structure. Smooth motion is assured with sealed ball bearings on all rotation points. The camera dome is molded high impact thermoplastic and internally reinforced with a composite laminate. A flush offset lens allows for a full horizontal pilots view. And custom mounting brackets are available for your installation.

The BTC-88 is fully compatible with the Procerus Virtual Cockpit™ ground control software and OnPoint™ Targeting software, making "Click N' Fly" operation easy while providing powerful mission planning, monitoring, and in-flight adjustment. This makes the BTC-88 ideal for all surveillance and reconnaissance applications. And at 220 grams, the BTC-88 is one of the smallest and lightest full-featured gimbals on the market with digital and optical zoom capabilities.

➤ Kestrel and Virtual Cockpit are trademarks of Procerus Technologies.

## SONY FCB-IX 11 VIDEO CAMERA

- Format: NTSC / PAL
- Operating Voltage: 6-12 VDC
- Current Consumption 2.1 Watts
- High Resolution: 470 TV Lines
- 752(H) x 582(V) (~ 440,000 pixels)
- 10x optical zoom, 4x digital zoom (40x)
- 1/4" type Ex-view HAD CCD
- Auto white-balance (user selectable)
- Weight: 3.0 oz. (95 grams)
- Operating Temperature: 0 – 50 C
- S/N Ratio: more than 50 dB
- Minimum Lighting Condition: 1.5 lux
- Horizontal View Angle: 46 degrees to 4.6 degrees
- Focal Length: 4.2 mm (wide) to 42 mm (tele)



A setup application for the Sony FCB-IX 11 Camera can be found at [www.sony.com/videocameras](http://www.sony.com/videocameras)

## DESCRIPTION OF APPLICATIONS FOR BTC-88 GIMBAL

### Smart Loiters

Using the BTC-88 Gimballed camera the user can center an object / target in their field of view and click "loiter now". The Kestrel will geo-locate the target and place a loiter point at that location and direct the UAV to it. The Kestrel then calculates the optimal radius and eccentricity to keep the object in the center of the FOV. If a gimbal is present, the autopilot will stabilize the camera and keep the gimbal pointed at the target.

### GPS Targeting

Using Virtual Cockpit™, users can instruct the autopilot to "Target Gimbal Here" on the map. A cross hair is placed on the target and the gimbal remains locked on. Click-n-drag the cross hair to new targets as desired. The gimbal follows and locks on independent of flight path. Terrain elevation data is utilized for greater accuracy. The gimbal can also be used to geo-locate objects with a single click.

### OnPoint™ Target Localization

Vision-based target localization using OnPoint™ targeting allows the user to obtain GPS coordinates of desired ground

targets to within 5m or less. Terrain Elevation Data is utilized to maximize accuracy. Users can click in the video on a desired target and the autopilot will fly the UAV to the object and loiter about it - within 1 revolution GPS coordinates will be given to within 3-5m accuracy. If the target moves, the user can repeatedly click on the moving target and the UAV will follow, providing GPS coordinates as it does so.

### Gimbal Features in Procerus Virtual Cockpit™

- Terrain Elevation Data is used for gimbal pointing accuracy.
- Gimbal Mode status displayed in Artificial Horizon.
- Gimbal position indicators on-screen.
- "Flashlight" view displays image frustum on map to aid user.
- Gimbal multi-point calibration and configuration screen.
- Smooth panning with hand controller.
- Control, Retract, or Change gimbal mode with gamepad.
- Click-n-drag crosshair – gimbal follows and locks on target.
- Autopilot optimized gimbal loiters. (point click - Kestrel computes radius)

## ABSOLUTE MAXIMUM RATINGS

Input Supply Voltage (Camera) ..... 0V to 12V  
 Input Supply Voltage (Servos)..... 0V to 6.0V  
 Operating Temperature Range ..... 0°C to 50°C  
 Storage Temperature Range..... 0°C to 50°C  
 Humidity ..... 5% to 95%, no condensing

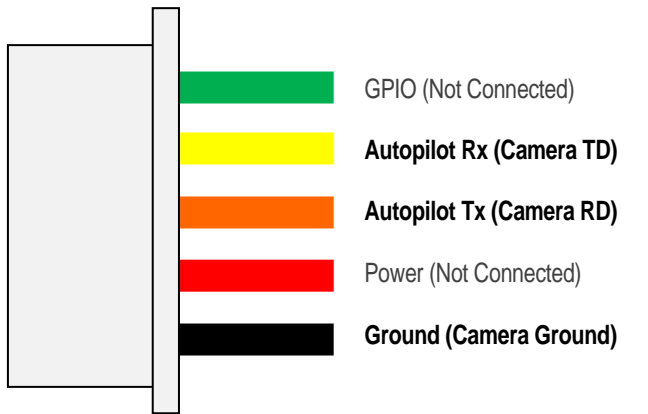
Stresses above those listed under the Absolute Maximum Ratings may cause permanent damage to this device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## OPERATING CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Camera Input Voltage		9.0	11	12	V
Servo Input Voltage (Each)		4.8	5.0	6.0	V
Camera Control					
Logic High (TTL)		3.0	3.3	5.0	V
Logic Low (TTL)		0		0.8	V
Dimensions			4.5" x 3.5" x 3.5"		inches
Weight			220		grams

## PORT FUNCTIONS

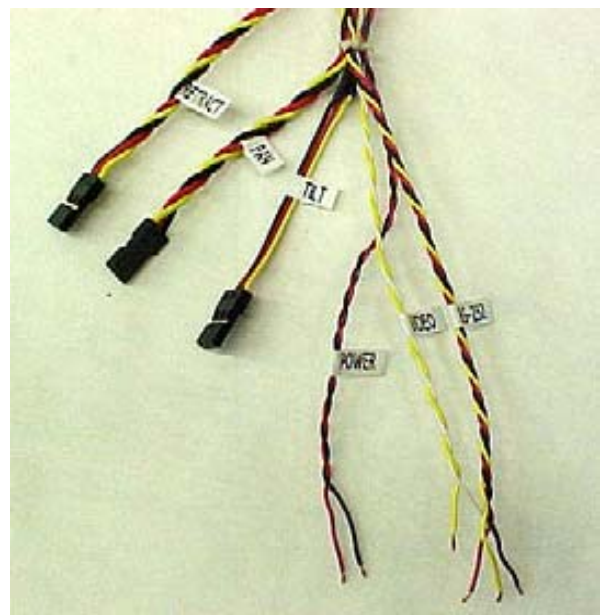
The following section describes the pin assignments for each port type. The Pan, Tilt, and Retract servo cables plug directly into the Kestrel Servo Expansion Board as Gimbal Azimuth, Gimbal Elevation, and Gimbal Retract (Ch6) respectively. The digital servos used in the BTC-88 require 4.8-6.0V DC. Video Camera power can be connected to any 6-12VDC power source. Camera video can be connected to any NTSC composite video transmitter. The camera is controlled through TTL level serial signals through Port A of the Kestrel Autopilot.



Pinout of Kestrel TTL Connector (Port A)



Pinout of Sony FCB-IX Video Camera



Wiring for the BTC-88 Gimbal

## RELATED PARTS

Part Number	Manufacturer	Description	Comments
MOLEX5POS-L10	Procerus Technologies	12-inch cable pigtails (2) for camera zoom connections.	
JST3POS-L6	Procerus Technologies	3pos, 6-inch pigtail cable for servo and power connections.	
R101-0513+ADAP	Procerus Technologies	Programming Cable with Pigtail	
51021-0500	Molex/Walden	5 pin Molex connector housing. Use w/ serial ports.	CONN HOUSING 5POS 1.25MM
50058-8000	Molex/Walden	Terminal crimp for Molex connector.	CONN TERM FEMALE 28-32AWG TIN
ZHR-3	JST Sales Amer.	3 pin JST connector housing. Used w/ servo ports.	CONN HOUSING ZH 3POS 1.5MM
SZH-003T-P0.5	JST Sales Amer.	Terminal crimp for JST connector.	CONN TERM FEMALE 28-32AWG TIN