



**DURO<sup>®</sup>**

## PRODUCT SUMMARY

### RUGGEDIZED MULTI-BAND, MULTI-CONSTELLATION CENTIMETER-ACCURATE GNSS

Carnegie Robotics offers Duro—a user friendly ruggedized GNSS-INS pose device built around the Piksi<sup>®</sup> Multi dual-frequency RTK GNSS receiver. Built for the outdoors, Duro combines centimeter-accurate positioning with military grade durability at a breakthrough price.

**RUGGED** Duro leverages design principles typically used in military hardware and results in an easy-to-deploy sensor, protected against weather, moisture, vibration, dust, water immersion and unexpected circumstances that can occur in long-term, outdoor deployments.

**EASY INTEGRATION** Duro's M12 connectors are sealed and industry standard, which balances ruggedization perfectly with user-friendly design. No external sealing is required to deploy in even the harshest conditions. A variety of interfaces are supported, including RS232 and Ethernet, to allow for flexible integration.

**LEVERAGES PIKSI MULTI RECEIVER** Multiple signal bands for fast convergence times and multiple constellations for enhanced availability. Supports GPS L1/L2, GLONASS G1/G2, BeiDou B1/B2 and Galileo E1/E5b for positioning and RTK measurements. Leverages SBAS for robust sub-meter positioning in non-RTK mode.

**HIGH PERFORMANCE POSE FILTER** Carnegie Robotics proprietary SmoothPose sensor fusion software has been refined to provide a high quality pose signal in unique and challenging conditions. Versions of SmoothPose have been tailored for railroad, off highway, and marine applications. Contact us to discuss tuning the pose filter for your purpose.

**CENTIMETER-LEVEL ACCURACY** Piksi Multi receiver offers moving base real-time kinematic (RTK) mode for autonomous platforms that require very precise positioning. RTK is capable of providing location solutions that are 100 times more accurate than traditional GNSS.

**FAST CONVERGENCE TIMES** Multiple signal bands enable faster convergence times to high-precision mode. Single-band RTK systems converge in minutes, while Piksi Multi converges to a high-precision solution within seconds.



## FEATURES

- DUAL FREQUENCY RTK GNSS RECEIVER
- HIGH PERFORMANCE POSE FILTER
- CAST ALUMINUM CONSTRUCTION
- DURABLE AND CHEMICAL RESISTANT POWDER-COATING
- PASSIVE THERMAL DESIGN
- IP67 RATED
- ELECTRICAL PROTECTION ON ALL I/O
- ON-BOARD MEMS IMU
- STANDARD M12 CONNECTORS
- HIGH QUALITY INTERFACE CONSOLE
- COLORED STATUS LEDS

## BENEFITS

- CENTIMETER-LEVEL POSITIONING
- SMOOTH STABLE POSE SOLUTION
- RUGGEDIZED FOR LONG-TERM DEPLOYMENT
- EXTREME TEMPERATURE CAPABLE
- FLEXIBLE MOUNTING INTERFACES
- EASY TO SOURCE CABLES
- IN-FIELD SOFTWARE UPGRADES
- INTUITIVE DIAGNOSTICS
- COMPETITIVE PRICING



## ENVIRONMENTAL

OPERATING TEMPERATURE	-40° to 167°F (-40° to 75°C)
STORAGE TEMPERATURE	-40° to 185°F (-40° to 85°C)
INGRESS	IP67
SEAL LEAK RATE	0.04 psi/min. at 5 psig
HUMIDITY (OUTDOOR)	100% NON-CONDENSING
HUMIDITY (CABINET)	95% NON-CONDENSING
SHOCK (OPERATING)	40G FOR 15-23MS
SHOCK (SURVIVE)	65G FOR 8MS
VIBRATION (RANDOM)	7.7 GRMS 1 HR PER AXIS
VIBRATION (SINE)	5G 10HZ-2KHZ 30 MIN PER AXIS
ESD IMMUNITY	IEC 60945
ELECTROMAGNETIC COMPATIBILITY	IEC 60945 & ISO 25197

## ELECTRICAL

VOLTAGE RANGE	10 - 35 VDC
POWER (NOMINAL)	5W
INPUT CONDITIONING	REVERSE POLARITY SAG, SPIKES
ANTENNA OUTPUT VOLTAGE	4.85 VDC
MAX OUTPUT CURRENT	100mA

## PERFORMANCE DURING RTK OUTAGE

	POSITION ACCURACY 2-SIGMA [M] RMS		VELOCITY ACCURACY [M/S] RMS	
OUTAGES	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
1 SEC	0.02	0.06	0.04	0.02
5 SEC	0.05	0.09	0.04	0.03
10 SEC	0.17	0.16	0.06	0.05

## PHYSICAL

DIMENSIONS	5.1in x 5.1in x 2.6in (13.0cm x 13.0cm x 6.5cm)
WEIGHT	1.8lbs (0.8kg)
CONSTRUCTION	CAST ALUMINUM

## GNSS SPECIFICATIONS

HORIZONTAL ACCURACY	CEP 50 in SBAS: 0.4m (15in)
VELOCITY ACCURACY	GPS+HNS: 0.08m/s (3.1in/s)
TIME ACCURACY	60ns RMS
ATTITUDE ACCURACY (PITCH/ROLL)	0.2°
ATTITUDE ACCURACY (HEADING)	0.8°
RTK HORIZONTAL	0.01m (0.4in) + 1ppm
RTK VERTICAL	0.15m (5.9in) + 1ppm
RTK INITIALIZATION TIME	< 10s
RTK INITIALIZATION RELIABILITY	> 99%
GPS SIGNAL TRACKING	L1 / L2
GLONASS SIGNAL TRACKING	G1 / G2
BEIDOU SIGNAL TRACKING	B1 / B2
GALILEO SIGNAL TRACKING	E1 / E5B
SBAS SIGNAL TRACKING	EGNOS, WAAS, GAGAN, MSAS
POSITION UPDATE RATE	UP TO 10Hz
MAX OPERATING LIMITS (VELOCITY)	515m/s (1150mph)

## COMMUNICATION

NAVIGATION OUTPUTS	SBP AND NMEA 0183 (CONFIGURABLE)
REFERENCE INPUTS / OUTPUTS	RTCM 3.x
NETWORK PROTOCOL SUPPORT	NTRIP CLIENT

## INPUTS / OUTPUTS

A

ETHERNET M12-D/F 4 POS.	
1	TX +
2	RX +
3	TX -
4	RX -

B

SERIAL M12-A/F 8 POS	
1	SERIAL 0 TX
2	SERIAL 0 RX
3	CTS
4	EVENT C
5	GND
6	12V OUT
7	PPS OUT
8	RTS

C

GNSS ANTENNA TNC	
PIN	ANTENNA
BODY	CHASSIS

D

POWER M12-A/M 5 POS	
1	VOLTAGE IN
2	CHASSIS GND
3	POWER GND
4	PPS
5	EVENT A

E

AUX M12-A/F 17 POS			
1	CAN LOW	10	TX
2	5V OUT (0.25A MAX)	11	RX
3	RTS	12	CAN HIGH
4	CTS	13	PPS
5	12V OUT	14	GND
6	GND	15	RESERVED
7	RESERVED	16	EVENT B
8	RESERVED	17	DO / PV
9	RESERVED		

