
First Technology Safety Systems

Design Freeze Status

FLEX-PLI-GTR Development Optional Instrumentation

Bernard Been
FTSS Europe

Comments addressed from Design Freeze meeting
February 20th 2008, JARI, Tsukuba, Japan
Update March 27th , 2008

Content

- Scope of the project
- Potential options and priorities for optional instrumentation
- On Board Data Acquisition packaging
- Computer Aided Engineering model

Project Scope

- Options should not make the standard version more expensive/complicated
- Standard instrumentation will meet all specifications
 - Purpose Regulatory Testing
- Versions with options may not meet all specifications
 - Purpose Research & Development Testing
- It may not be feasible to achieve all options simultaneously
- In the next phase we will concentrate on the standard design
 - Complete options design is outside the scope of this project
 - Optional Instrumentation design will be executed based on customer requests

Channel	Purpose	Standard	Option	DAS	Priority
Femur moment 1, 2 and 3	Calibration	3	0	Standard option On board DAS	
Tibia moment 1, 2, 3 and 4	Injury	4	0		
Tibia top acceln ax	Calibration	1	-1		
MCL elongation	Injury	1	0		
ACL elongation	Calibration	1	0		
PCL elongation	Calibration	1	0		
LCL elongation	Calibration	1	0		
Tibia top acceln ax, ay, az	Motion	0	3	optional on board if feasibl	1
Femur bottm acceln ax, ay, az	Motion	0	3		1
Tibia angular rate $\omega_x, \omega_y, \omega_z$	Motion	0	3		2
Femur angular rate $\omega_x, \omega_y, \omega_z$	Motion	0	3		2
Femur top acceln ax, ay, az	Motion	0	3	Lab	3
Tibia bottom acceln ax, ay, az	Motion	0	3	Lab	3
Segment acceln ax	Research	0	15	Lab	4
Total		12	32		


Summary

On board pending feasibility

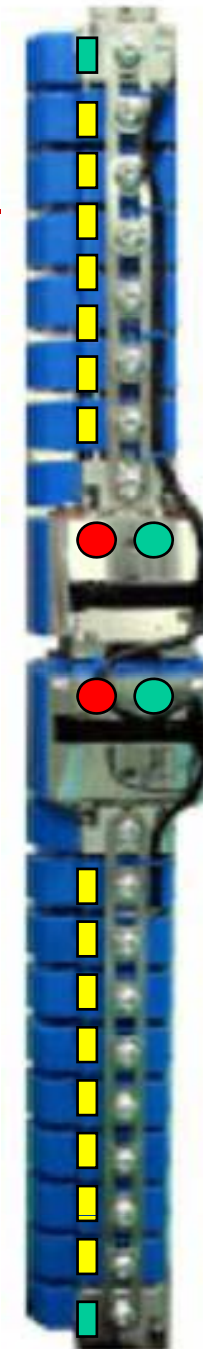
3 axis damped accelerometer 

3 axis angular velocity sensor 

Off board

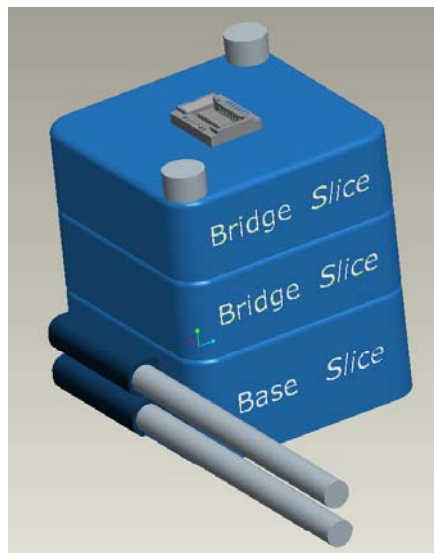
Attachment place for 3 axis damped accelerometer 

Attachment place for 1 axis damped accelerometer 



On Board Data Acquisition Systems

- High priority
- 'Standard' option
- Improve free flight motion control
- Packaging space is optimized, though still limited
 - Potential solutions meet packaging space



<http://www.e-sensing.com/>

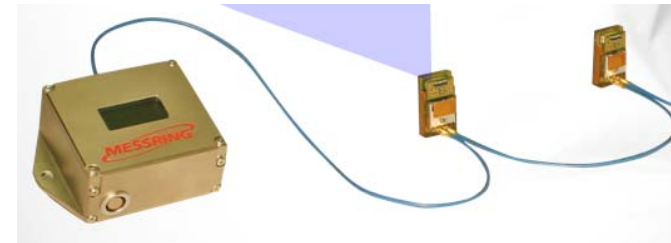
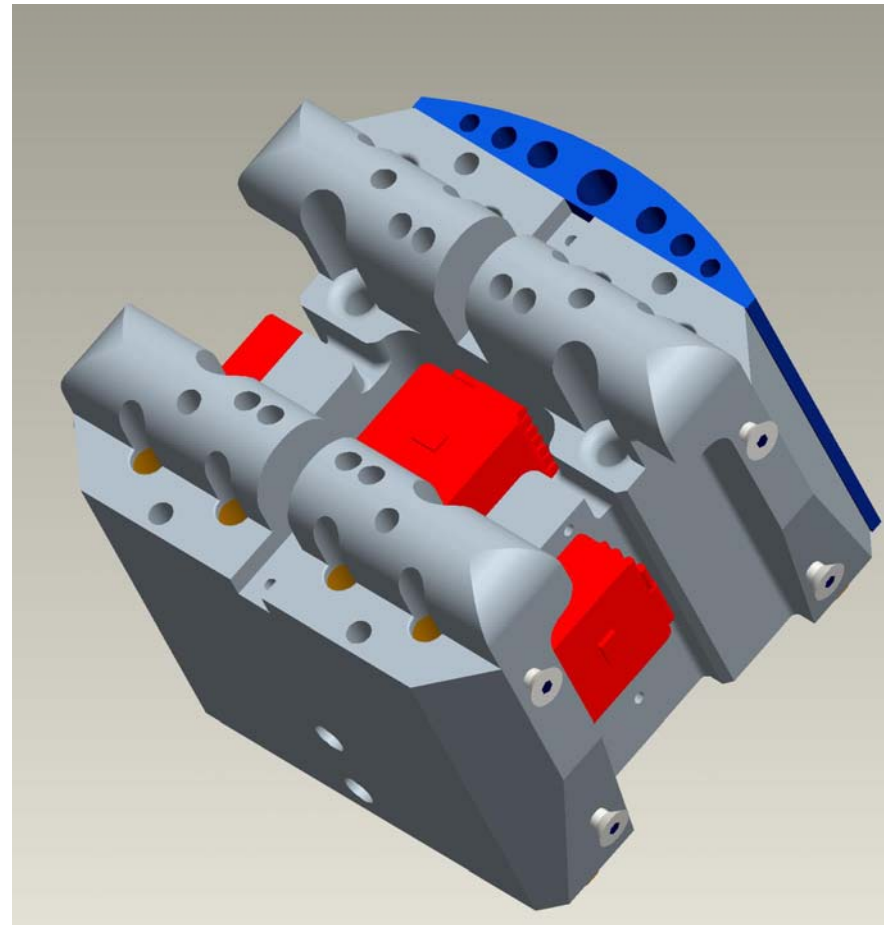
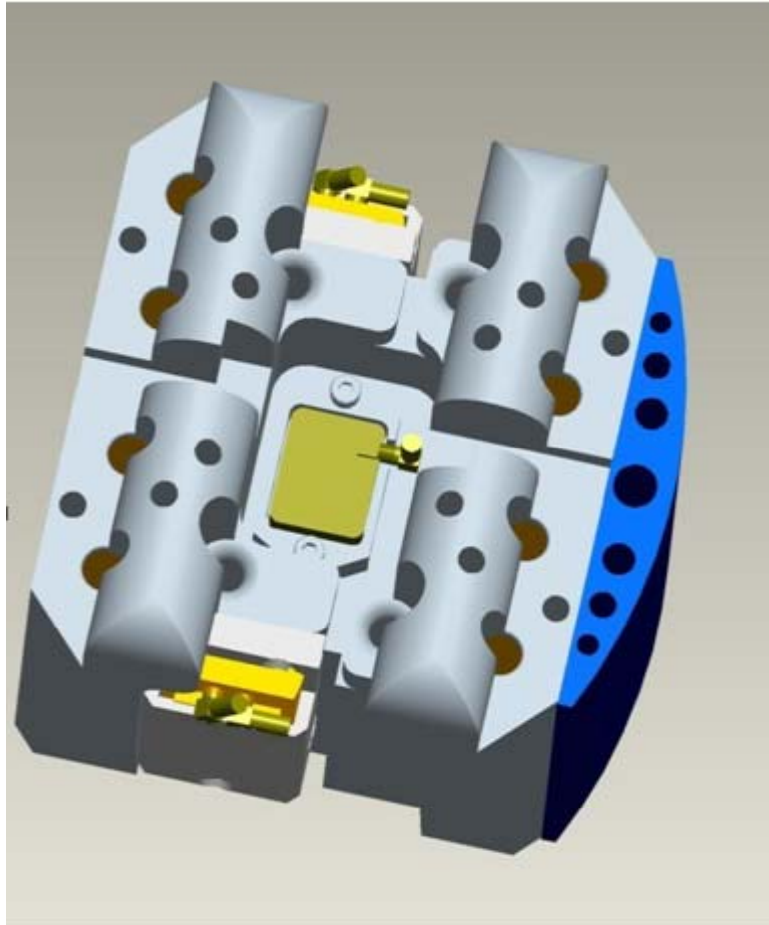


Figure 1 M=BUS®



<http://www.messring.de/>

Options Packaging Space

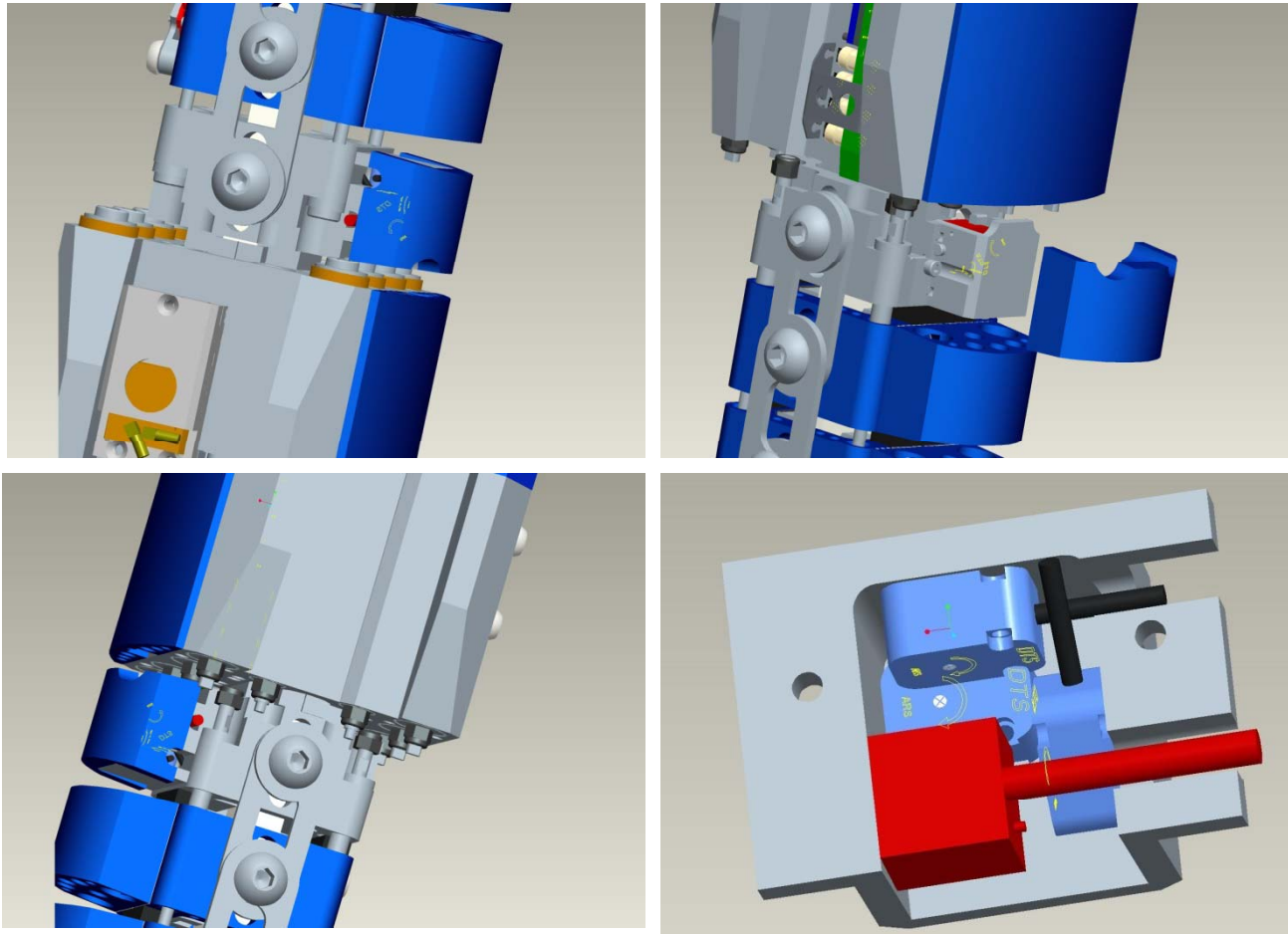


Packaging DAS, battery, wiring, connectors, auxiliaries, etc.

Form: 07-163
Revision: A
16 - May 07

 **First Technology**
Innovative Solutions

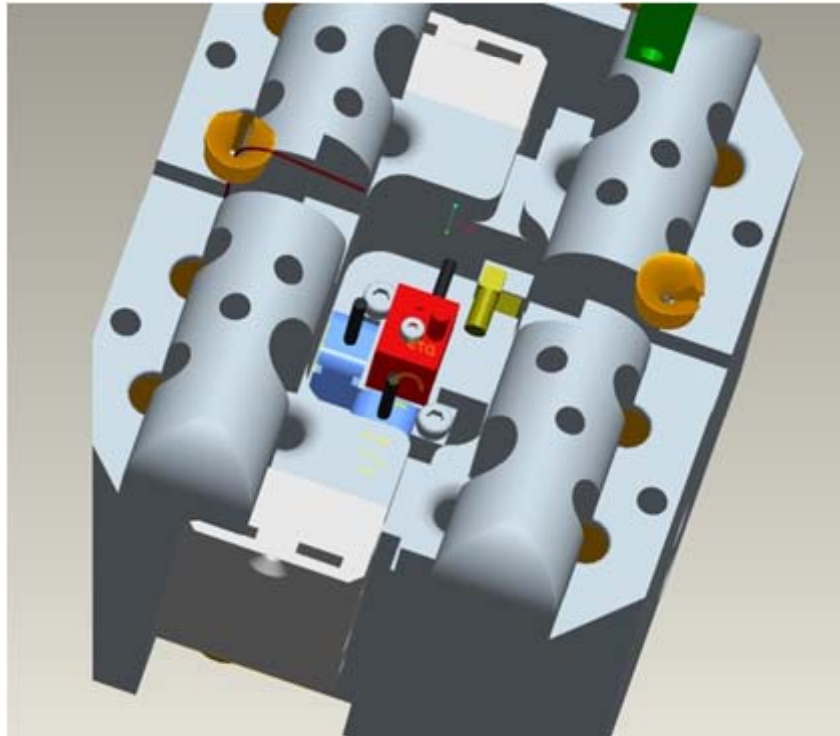
Tibia and Femur Knee Part



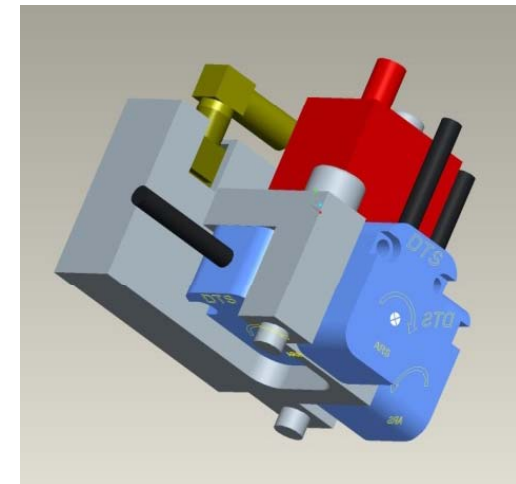
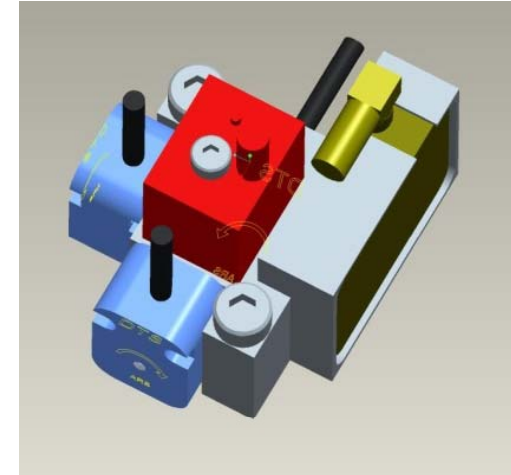
Measurement Specialties M68C Endevco 7268C
DTS Angular Rate Sensors

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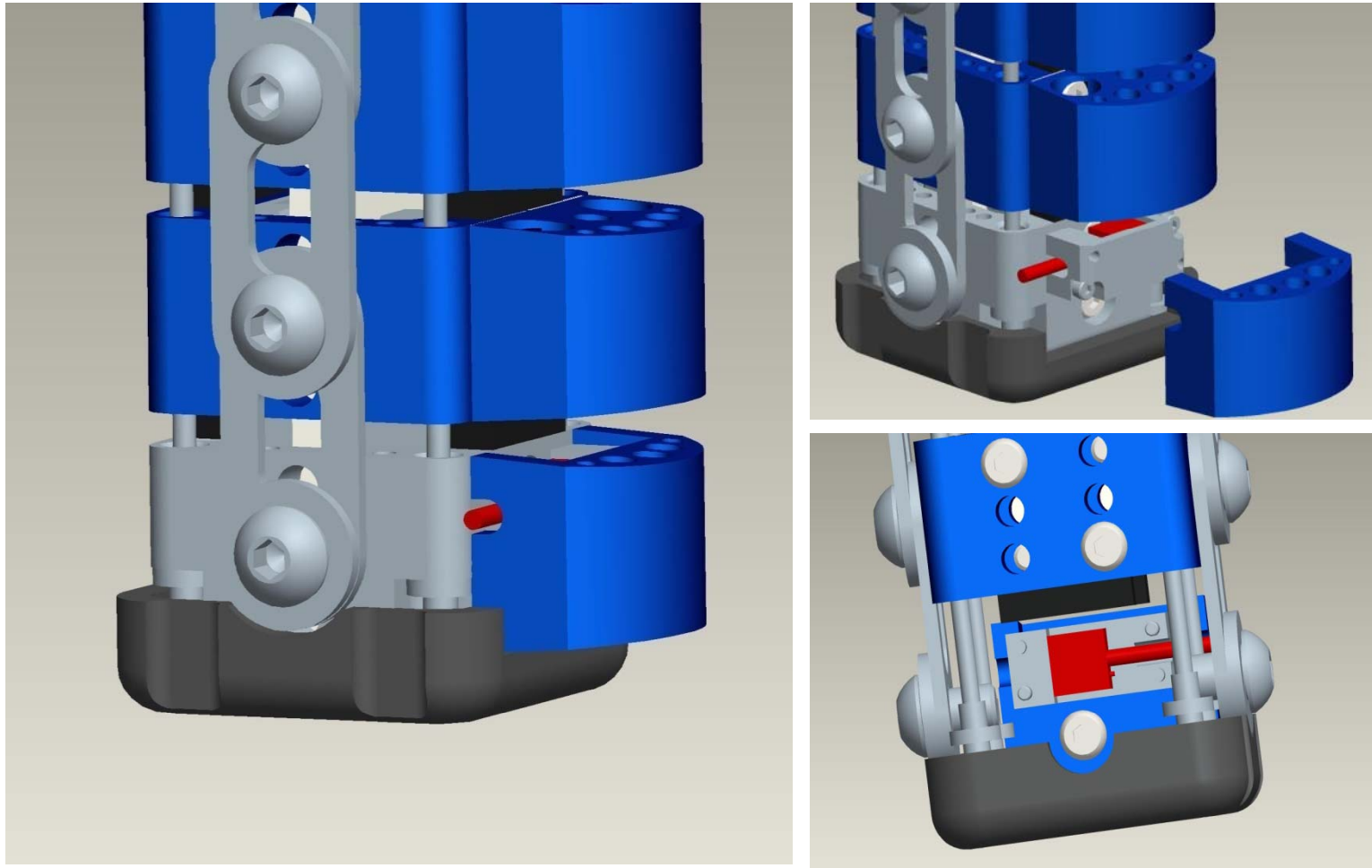
Alternative Sensors in Knee Triax and Angular rate sensors



- This idea is limited to the femur
- Calculate tibia motion from MCL, ACL, PCL



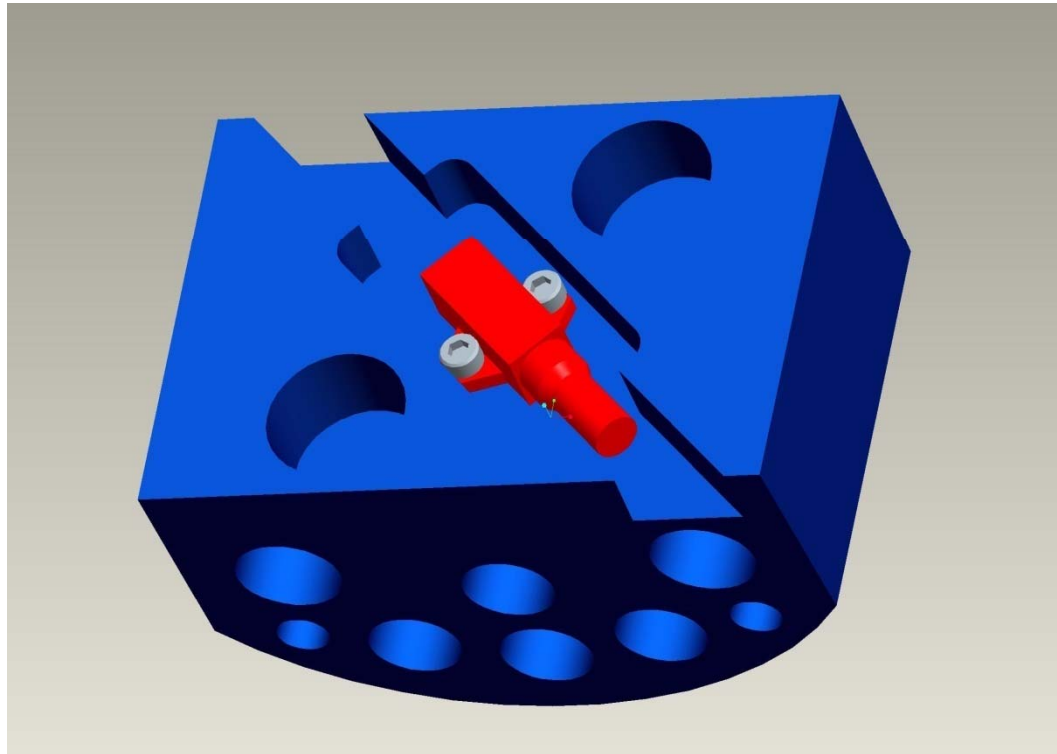
Triax accelerometer Distal Tibia (shown) and Proximal Femur



Measurement Specialties M68C or Endevco 7268

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Single axis accelerometer x-direction each segment



- Dedicated nylon segment for optional accelerometer
- Threaded metal insert
- Kyowa ASE, Measurement specialties M62, Endevco 7264

Option CAE model development

- FTSS proposes to develop a Flex-PLI-GTR CAE model through a consortium project parallel to the hardware development
- FTSS offers to take the responsibility to develop the models and co-ordinate the project
- The model(s) will become part of the FTSS model database and will be maintained and further enhanced accordingly
- The consortium members will fund the consortium project and will receive a free license allowing to use the model in the next 3 years

DTS-ARS SPECIFICATIONS

DTS-ARS – The Next Generation in Angular Rate Sensors

The DTS-ARS is the latest in intelligent design from DTS. With ranges as high as 12,000 deg/sec, these incredibly small and lightweight sensors have a remarkable DC to 2,000 Hz bandwidth. Suitable for many automotive, aerospace and industrial testing applications, the DTS-ARS can also be used inside crash test dummies for precise measurements of head rotation, thorax rotation and other biodynamic measurements. Re-calibration services are available.

Applications

- FMVSS 202a and rollover crash testing
- Side curtain deployment development
- Component testing
- Biodynamic research testing

Single axis DTS-ARS



DTS-ARS triax package with DTS mounting block



Part Number	Specifications	Additional Information
ARS-300	±300 deg/sec range SAE Class 60 response	Ships standard with pigtail termination. Options*: -C: add connector -CID: add connector and Dallas ID
ARS-1500	±1500 deg/sec range SAE Class 600 response	
ARS-12K	±12000 deg/sec range SAE Class 1000 response	Optional ranges*: 300 to 50,000 deg/sec Optional bandwidth*: 40 to 10,000 Hz * additional lead time required



A six-axis package is easily obtained by taking the DTS-ARS triax package shown above and mounting three standard Endevco 7264 or MSI 64 accelerometers.

DTS, Inc.
909 Electric Avenue, Suite 206
Seal Beach, CA 90740 USA
Phone: +1 562 493 0158
Fax: +1 562 493 3158
Email: sales@dtsweb.com
www.dtsweb.com

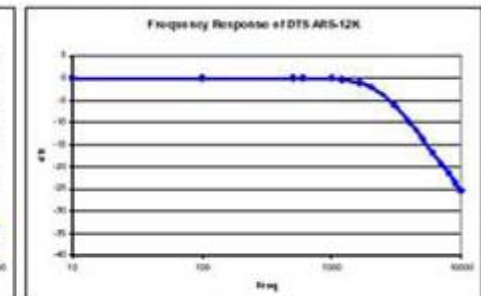
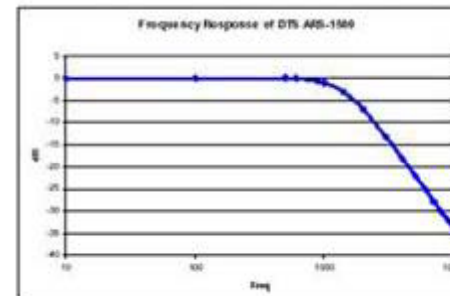


RANGE and FREQUENCY RESPONSE		
Range deg/sec (rad/sec)	Bandwidth* (Hz)	Noise (rms full scale)
300 (5.2)	DC to 100	<0.15%
1500 (26.2)	DC to 1000	<0.15%
12000 (209.4)	DC to 1650	<0.25%
ELECTRICAL		
Excitation	4.95 to 14.00 VDC; output not proportional to excitation	
Current	6 mA nominal	
Zero Output	±200 mV	
Full Scale Output	±2 V nominal	
PERFORMANCE		
Cross axis sensitivity	<1.0%	
Linearity	<0.5% full scale	
Influence of linear acceleration	0.2 deg/sec/g	
Drift	0.1 deg/sec/sec	

PHYSICAL	
Enclosure	Anodized aluminum
Size	0.3 x 0.4 x 0.58 inches 7.6 x 10.2 x 14.7 mm
Mass	<3 grams
Shock	2000 G, any direction
Cable	<ul style="list-style-type: none"> • four conductor, 28 AWG • Overall shield isolated from enclosure • Standard 25 ft (8.3 m) • Color code <ul style="list-style-type: none"> ○ Black: -Excitation ○ Red: +Excitation ○ Green: +Signal ○ White: -Signal
Temperature Range	-40 to +85°C
Humidity	99%, non-condensing
Connector	LEMO or other installed per request
Dallas ID	Installed in connector

Specifications may be revised without notice.

* Indicates flat response in this frequency range. The 1500 deg/sec ARS meets SAE Class 600 performance requirements. The 12000 deg/sec ARS meets SAE Class 1000. All DTS-ARS sensors have DC response. Nominal frequency response for 1500 and 12000 deg/sec units are show below.



Corporate Headquarters
909 Electric Ave., Suite 206
Seal Beach, CA 90740, USA
Phone: +1 562 493 0158
Fax: +1 562 493 3158
Email: sales@dtsweb.com
For a complete list of regional sales and support contacts, please visit www.dtsweb.com

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Design frozen!