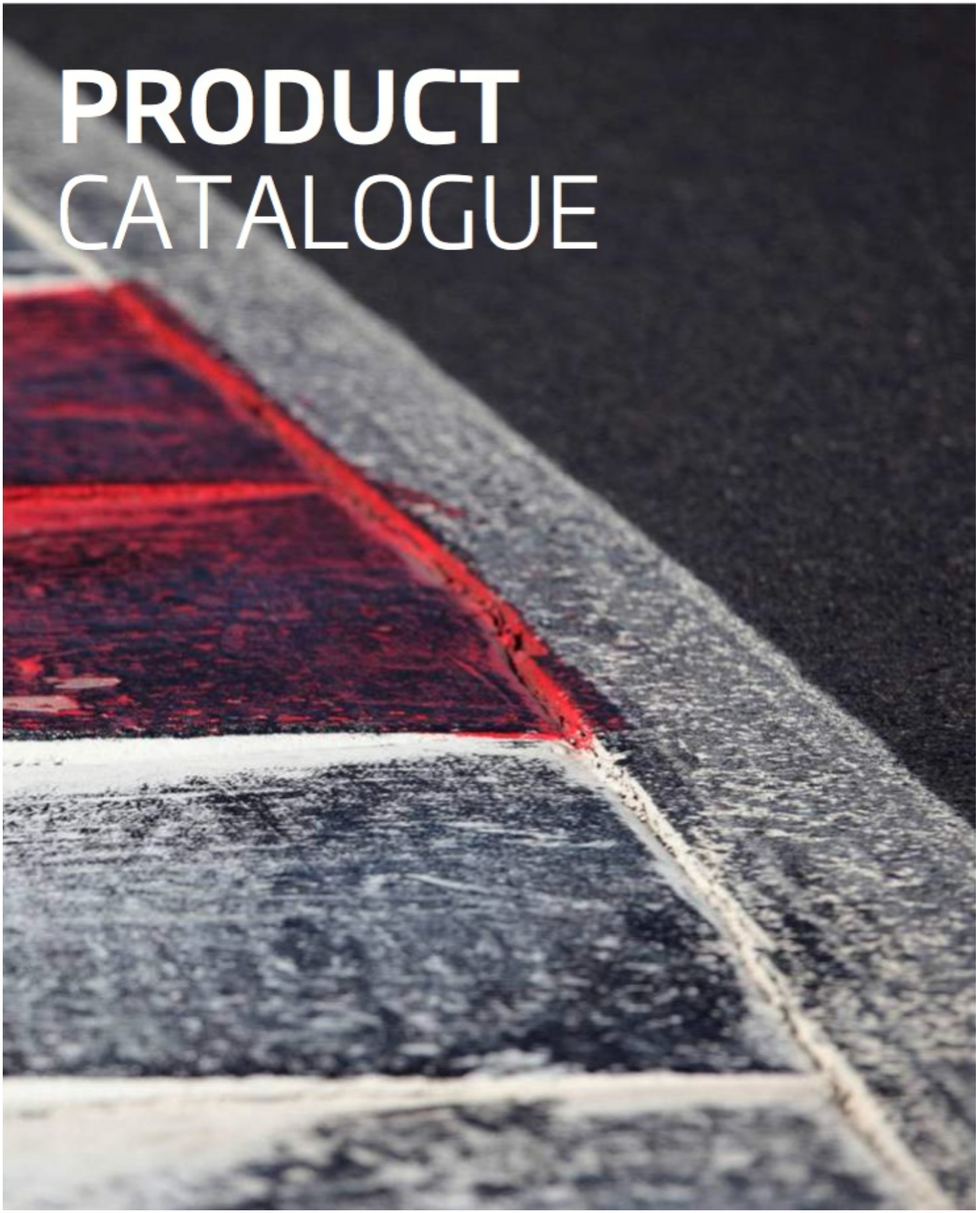
McLaren
APPLIED TECHNOLOGIES

PRODUCT CATALOGUE



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McLaren's expertise is rooted in five decades of success on the track – a heritage that stretches back to 1963, when Bruce McLaren fulfilled his dream of starting a Formula 1 team.

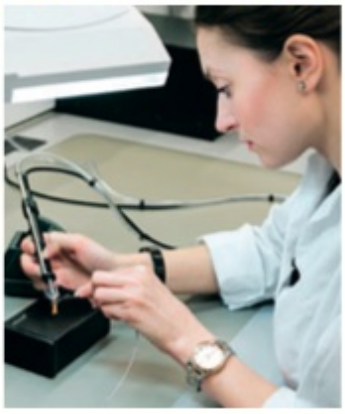
But motorsport isn't the only arena in which we're making a difference. You'll find McLaren solutions and electronics components performing vital, safety-critical work throughout the aerospace, transport and automotive sectors.

Global motorsport relies upon McLaren Applied Technologies' high-performance electronics, components and software to continue to set new standards across the industry. We supply the standard Electronic Control Units (ECUs) used in IndyCar, NASCAR and Formula 1, taking pride in developing products that are innovative, robust and utterly reliable – even in the most testing of environments. Our data acquisition systems are capable of acquiring data faster than any other product on the market and can also host onboard algorithms running in real-time.

Our equipment is favoured by teams and engine makers in Endurance, Rally, Racing and motorcycle, in addition to many other racing categories. We are responsible for the standardised electronic control system for the FIA Formula E Championship, a series that's driving forward innovation in electric vehicle technology. Our systems are known to be reliable and high performance, whilst also offering the high levels of safety and security demanded by our uncompromising customer base.

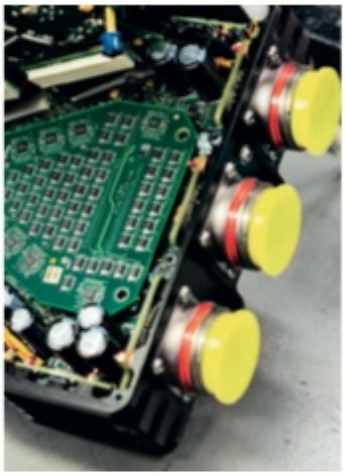
The McLaren Applied Technologies catalogue includes electronics, sensors, electrical components and software. As well as our flagship Control Systems, our range of electronics includes self-contained data loggers and state of the art telemetry units. We produce sensors to measure torque, temperature, pressure, acceleration. All are built to be compact, accurate and consistent.

High-output alternators are the bedrock of our electrical range. Their users include World Rally Car, GT, NASCAR and World Endurance Racing teams, and with good reason. Every alternator is hand-wound by dedicated craftsmen – a meticulous and time-consuming process that significantly improves quality and performance.



We are world leaders in real-time data recording, display and analysis software which have applications in competitive motorsport and beyond. Through the use of our innovative graphical development environments, we can also develop code for all of our control systems and data loggers.

This extensive catalogue of standard products is only part of the story. We have in house experts in design through to production and QA that can produce bespoke solutions that are precision-engineered to fulfil the most specialised of functions. Whether you're looking for a variant of an existing product or an entirely new component, we can agree a specification, design and build it to the tightest of timescales. Our culture is never to ask whether it can be done – only how.



Every single item that bears the McLaren name is made to the same exacting standards. Our off-the-shelf products are direct descendants of the ones that are found in Formula 1 and NASCAR vehicles, and born of the same world-leading research.

Get in touch to find out more about how McLaren Applied Technologies can meet your motorsport needs and exceed your expectations.

Please email **sales@mclaren.com** or telephone **+44 (0) 1483 261400** for the UK and worldwide or **+1 704 660 3181** for the United States.

Case Studies

TAG-320

The ECU is among the hardest-working components of a modern Formula 1 car. Tim Strafford, commercial director at McLaren Applied Technologies says: "It's responsible for all control activities on the car, from engine and gearbox control right through to controlling the driver's drink pump. With the exception of steering and brakes, which remain largely mechanical systems, all other functions are 'drive by wire', meaning they are commanded via buttons and switches routed through the ECU."

In case that is not enough to be getting on with, the ECU has to handle almost 100 data streams from sensors on the car and engine. Tim says: "The TAG-320 hosts 96 analogue inputs that are used to capture data from sensors around the car and engine. These are used for control and monitoring purposes, and all are capable of acquiring data at speeds of 10kHz or more."

Formula 1 underwent a quiet revolution in 2013. When the cars lined up on the grid for the opening Australian Grand Prix, each had a new piece of technology at its heart – a TAG-320 engine control unit (ECU) developed and built by McLaren Applied Technologies.

The unit was developed as a replacement for the TAG-310B, another McLaren product. The FIA had introduced this in 2008 as the first Standard ECU to control both engine and chassis functions, with the aim of standardising driver aids and keeping down costs. Previously, teams and engine builders had been free to use their own units.

Tim says: "The introduction of the TAG-320 into Formula One has been very successful. It offers more performance and more features, and maintains the high level of reliability that is expected of our products."

To cope with the demands of modern racing, the TAG-320 has twice the processing power of its predecessor. Yet the new unit is the same size and shape as the TAG-310B: a distinctive trapezoid of just 154 x 167mm across its longest axes. "It really does represent the art of the possible in terms of electronic system density," says Tim. "We set out to produce a unit of the same dimensions, but it wasn't long before regretted such an ambitious self-imposed target!"

With the old TAG-310B, teams were confined to using the Standard ECU software and were locked out from running

their own code. This ensured that they were unable to develop driver aids that could confer an unfair advantage. However, the architecture of the TAG-320 permits the teams to develop their own applications, subject to certain safeguards.

Tim says: "We set out to create a system that would support applications written by the teams, but with security mechanisms that could limit the authority of such applications and thus prevent teams from developing driver aids. This new feature has been used to good effect."

Success in Formula 1 has prompted other clients to seek out the TAG-320. "It's not surprising that a range of new opportunities have arisen for the unit," says Tim. "One achievement has been its gradual adoption into LMP1, as the control unit of choice for manufacturers who are serious about competing at the top of the World Endurance Championship."

Electrical

Alternators

DC2 Voltage Regulator

The 30A DC2 rectifier/regulator is for use with 3 phase permanent magnet alternators. It uses “Buck” circuitry which stores and regenerates some of the energy which would otherwise be lost during switching. The output may be set, at the factory, to any voltage between 13 and 14V DC. A signal line is provided to switch off the regulator, for example, to reduce load on the engine. An internal sensor is provided to monitor temperature. The DC2 has a single integral, military standard connector.

In Detail

Application

- Motorcycles and single seat racing cars.

Electrical

- Output 13.9±0.1V DC (at 25°C and 25A output)

Any voltage between 13 and 14V can be set on request

- Current output 25A (typ.), 30A (max*)
- Current demand of regulator circuitry

50mA (typ.), 800µA (quiescent)

- Output impedance <20mohm
- Output voltage thermal drift +4.4mV/°C
- Output voltage h.f. noise <±200mV pp
- Input voltage not to exceed 200V
- Input current not to exceed 35A rms per phase
- Alternator source impedance must exceed 50mohm
- Minimum current for normal regulation 0.5A
- Minimum input voltage for normal regulation 14V (for input between 5 and 14V the output tracks the input; for input below 5V the regulator switches off)

- Temperature output 114.9xV(T)-187.3°C
- Temperature output accuracy 0.5% between 0 and 100°C

Connection Definition

- Integral, sealed, military standard connector AS0-14-35PN-9920
-

Pins 1 to 4	Input Phase 1
Pins 5 to 8	Input Phase 2
Pins 9 to 12	Input Phase 3
Pins 13 to 20	Regulated DC output
Pins 21 to 34	Ground
Pin 35	Temperature signal V (T)
Pin 36	Temperature ground ref.
Pin 37	Output control line

Phases are interchangeable

The regulator is switched off by connecting the output control line to ground. Ensure that the output control line is not grounded during power up

Mechanical

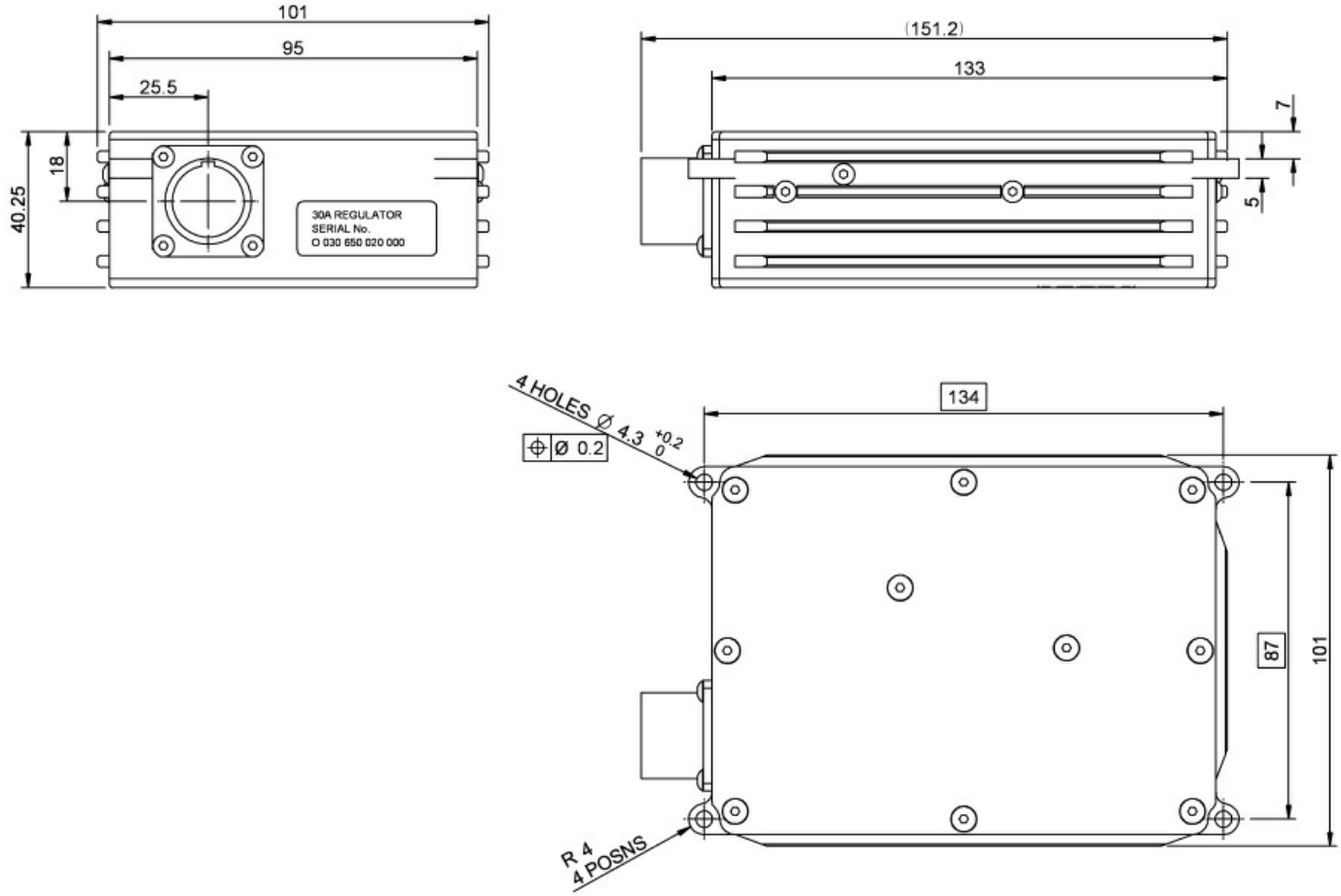
- Case material: see ordercode details, options :
  - Magnesium, chromate converted and painted with black epoxy
  - Aluminium hard anodised and dyed black
  - Weight: see ordercode details

Environmental

- Splash resistant to standard motorsport fluids
- Lids and screws sealed with silicone rubber
- Maximum humidity 100%
- Temperature not to exceed 80°C as measured at the centre of any of the finned walls
- Power Dissipation between 47 and 105W

Images/Diagrams

DC2 Voltage Regulator



Ordercodes

Description	Ordercode
DC2 Voltage Regulator <680g	O 030 650 020 002
DC2 Voltage Regulator <780g	O 030 650 020 011

DC3 Voltage Regulator

The 22A DC3 rectifier/regulator is for use with 3 phase permanent magnet alternators. The design uses a “Buck” switchmode architecture for excellent efficiency.

The output may be set, at the factory, to any voltage between 13V and 15V DC. Two outputs are provided, one unswitched, intended for connection to a 12V lead-acid battery and one switchable under the control of an external input. Internal sensors are provided to monitor main-board temperature and net current from the regulator. The DC3 has a single integral, military standard connector.

In Detail

Application

- Motorcycles
- Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. Please contact our technical consultancy service who will be pleased to help.

Electrical

- Peak phase-phase input voltage not to exceed 200V
- Input current not to exceed 25A rms per phase
- Alternator source impedance must exceed 50 mOhm
    - 14.3V at 0A
    - 13.7V at 22A on 14V_SW output
- Voltage can be factory set between 13V and 15V
- Output voltage thermal drift less than -3mV/°C
- When the internally rectified alternator voltage falls below the nominal regulated output voltage, the output voltage tracks the input voltage down to about 5V output
- Current output 22A max
    - Isensed = Vsensor * 6.666 – 3.333
    - Accuracy better than +/-0.5A
    - Tsensed = Vsensor * 114.0 - 183.9
    - Accuracy better than +/-1°C over 0 to 100 °C

- Regulator will operate with or without a battery connected to 14V_BAT. Quiescent current drain from battery when alternator stopped is 6mA typical.
- Power Dissipation 58W at 15V 22A output

Mechanical

  - Magnesium, chromate converted and painted with black epoxys
  - Aluminium, hard anodised and dyed black

- Weight: see ordercode details

Connector

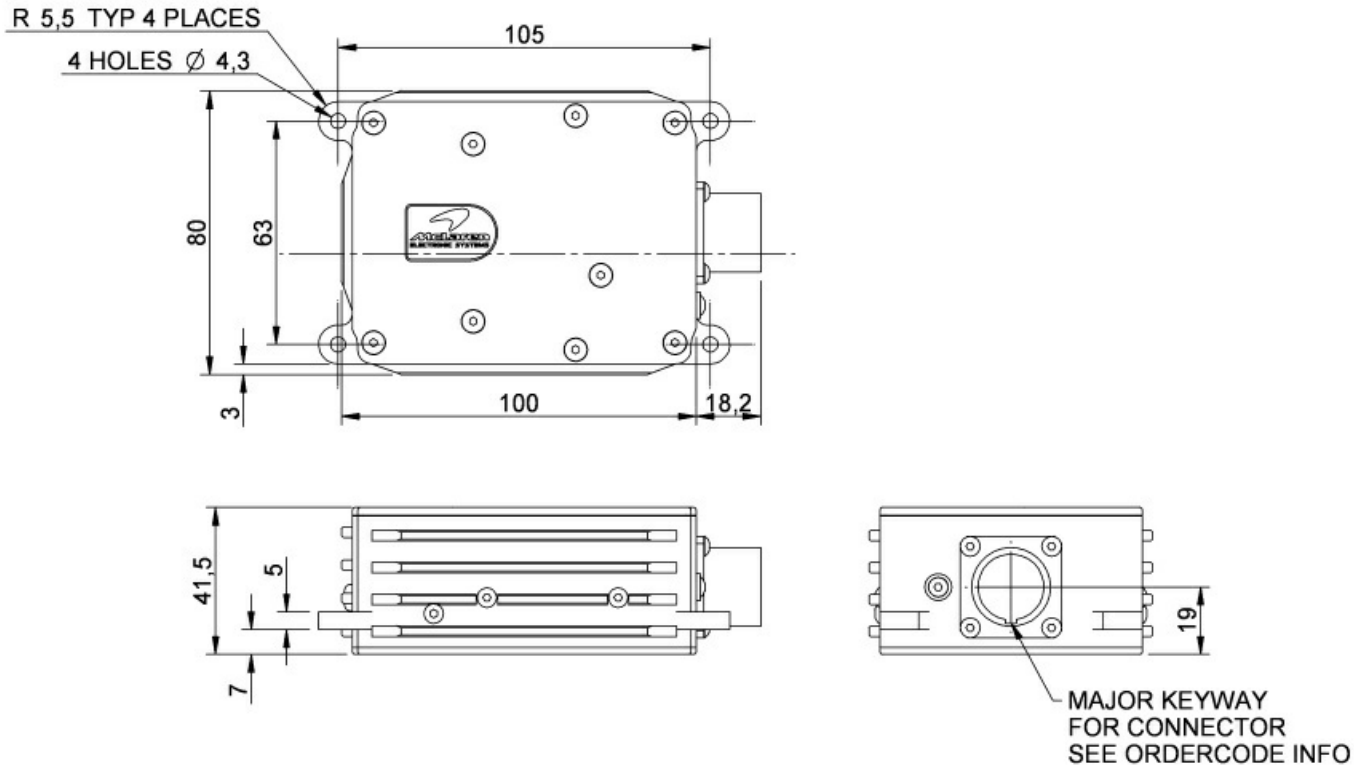
Phases are interchangeable

Environmental

- Splash resistant to standard motorsport fluids
- Storage temperature -20°C to + 85°C
- Operating temperature -10°C to + 70°C as measured by internal temperature sensor
- Forced air cooling over the unit is essential
- Lids and screws sealed with silicone rubber
- Maximum humidity 100%

Images/Diagrams

DC3 Voltage Regulator



Ordercodes

Description	Ordercode
DC3 Voltage Regulator <450g	O 030 650 028 000
DC3 Voltage Regulator <520g	O 030 650 028 001

F-Type Alternator 90Amps

The F type alternator has a specially wound stator to achieve high power output in a small, low weight package. High current diodes are used in the rectifier and internal fans provide forced air cooling. The output is controlled by a regulator inside the alternator. The units are assembled with stiff brush springs and extra flexible wire to connect the stator to the rectifier. The stator is pegged to the body and all screws are locked. High quality bearings are used to enable the alternators to run at high speeds (up to 18,000 rpm). The standard mounting method is intended for a belt drive, but the alternator may also be driven directly, if required.

Please request our installation datasheet for further details.

In Detail

Electrical

- Output voltage 13.5V DC
- Nominal output current
-

High	110A	(cut in speed 3200rpm)
Medium	90A	(cut in speed 2400rpm)
Standard	60A	(cut in speed 1700rpm)

A detailed performance chart is shown later in this document.

Mechanical

- Aluminium alloy body
- Maximum speed 18,000rpm
- Clockwise rotation
- Weight <2.9kg F-type
- Potted elastomer boot for strain relief of cable (where fitted)

For high vibration installations, the strapped F type is recommended. The rectifier is strapped to provide improved mechanical support

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost

effective customised parts to suit even the most demanding application.

For example:

- Through bored mounting holes
- High accuracy machining of mounting flanges
- Alternative cable entry locations
- Alternative connectors
- The regulator/rectifier unit may be rotated through 90°, 180° or 270°

Please contact our technical consultancy service who will be pleased to help.

Connection Definition

- 22AWG cable (where fitted)
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Positive power output M8 stud
- Ground connection for power and regulator is through the case. Ensure that the case has a high current, low resistance connection to vehicle ground.
- Cable connection
-

Green wire	Pin A	Pin 1	Ignition
Red wire	Pin B	Pin 2	Sense
White wire	Pin C	Pin 3	Lamp

- Connections for the integral connector (where fitted) are shown on the drawings

Environmental

- Splash resistant to standard motorsport fluids
- Viton jacketed cable
- Continuous ambient operating temperature -30 to +90°C
- Maximum ambient temperature 110°C short term, providing the following temperatures are not exceeded:
-

Stator	200°C
Diodes	180°C
Regulator	115°C
Bearings	150°C

Power Curve

The F-Type Alternator is available in 3 key outputs.

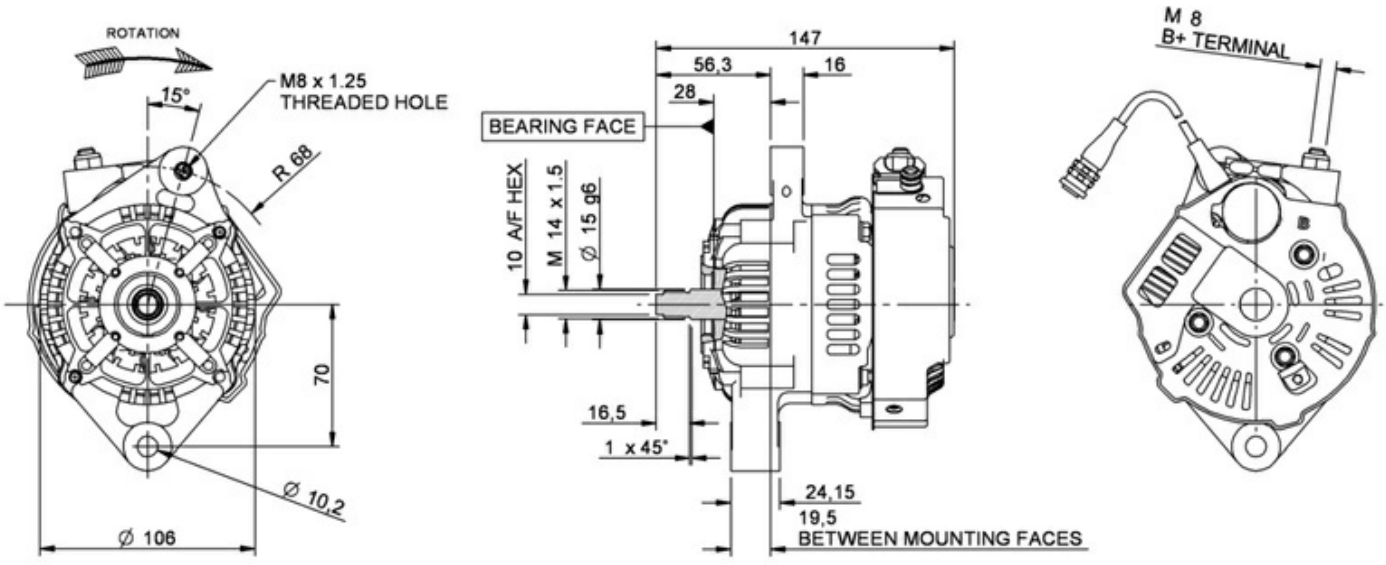
Output in Amps (@13.5V)

Nominal Current Rating		Standard 40A		Medium 60A		High 90A	
Cut in Speed		1200rpm		1700rpm		2700rpm	
Ambient Temperature		25°C	90°C	24°C	90°C	25°C	90°C
Speed (rpm)	2500	24	18	20	18	5	5
	5000	37	30	51	41	58	56
	7500	42	35	57	50	77	73
	10000	45	38	65	57	90	85
	12500	47	39	67	60	94	92
	15000	48	40	69	61	95	93

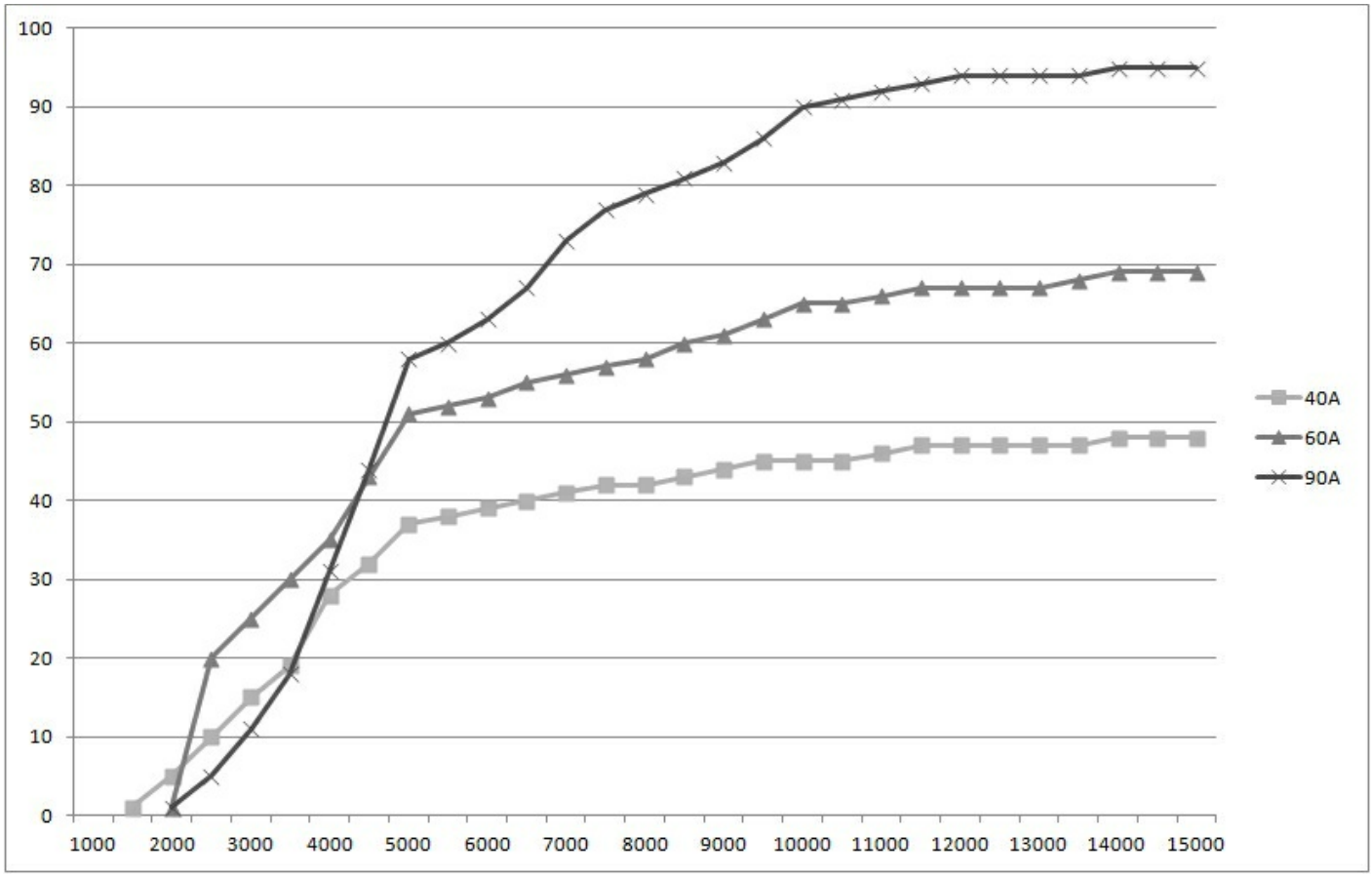
Images/Diagrams

F-Type Alterator

O 030 650 003 XXX



F-Type Alternator Power Curve



Ordercodes

Description	Ordercode
90 Amp	O 030 650 003 038
60 Amp	O 030 650 003 052

G-Type Alternator Up to 180 Amps

This alternator has a specially wound stator to achieve high power output in a small, low weight package. High current diodes are used in the rectifier and internal fans provide forced air cooling. The output is controlled by a regulator inside the alternator. The units are assembled with stiff brush springs and extra flexible wire to connect the stator to the rectifier.

The stator is pegged to the body and all screws are locked. High quality bearings are used to enable the alternators to run at high speeds (up to 18,000rpm). The standard mounting method is intended for a belt drive, but the alternator may also be driven directly, if required.

Please request our installation datasheet for further details.

In Detail

Electrical

- Output voltage 14.5V DC
- Nominal output current up to 180A at 10,000 RPM (cut in speed 3500rpm)

A detailed performance chart is shown on the next page.

Mechancial

- Weight: <3.5kg
- Aluminium alloy body
- Moulded Polymer rear cover
- Maximum speed 18,000rpm
- Rotation clockwise
- Rectifier strapped

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application.

Please contact our technical consultancy service who will be pleased to help.

Connection Definition

- Positive power output M8 stud (B+ terminal)
- Ground connection for power and regulator is through the case. Ensures that the case has a high current, low

resistance connection to vehicle ground

Cable connection

Green	Pin A	Pin 1	Ignition
Red	Pin B	Pin 2	Sense
White	Pin C	Pin 3	Lamp

Single connection details: Ignition and sense connections are through the power output stud (B+ terminal)

Environmental

- Splash resistant to standard motorsport fluids
- Continuous ambient operating temperature -30 to +90°C
- Maximum ambient temperature 110°C short term.

Providing the following temperatures are not exceeded:

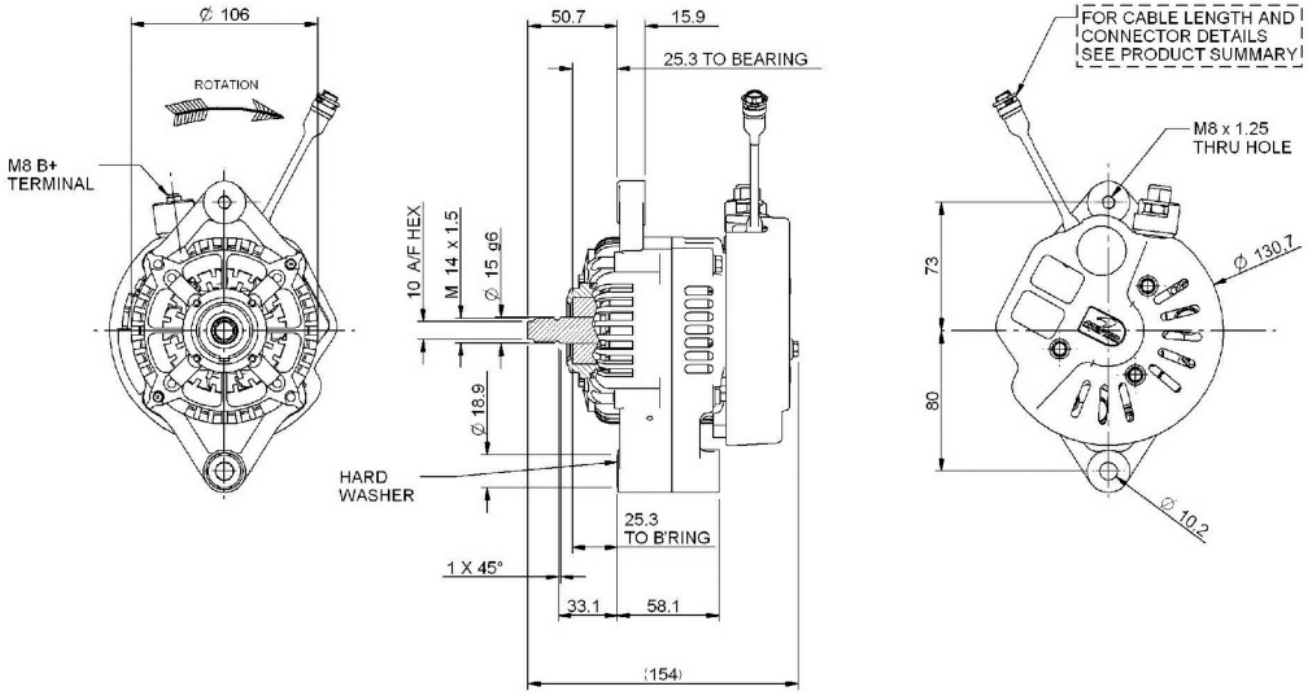
Stator	200°C
Diodes	175°C
Regulator	105°C
Bearings	150°C

Power Curve

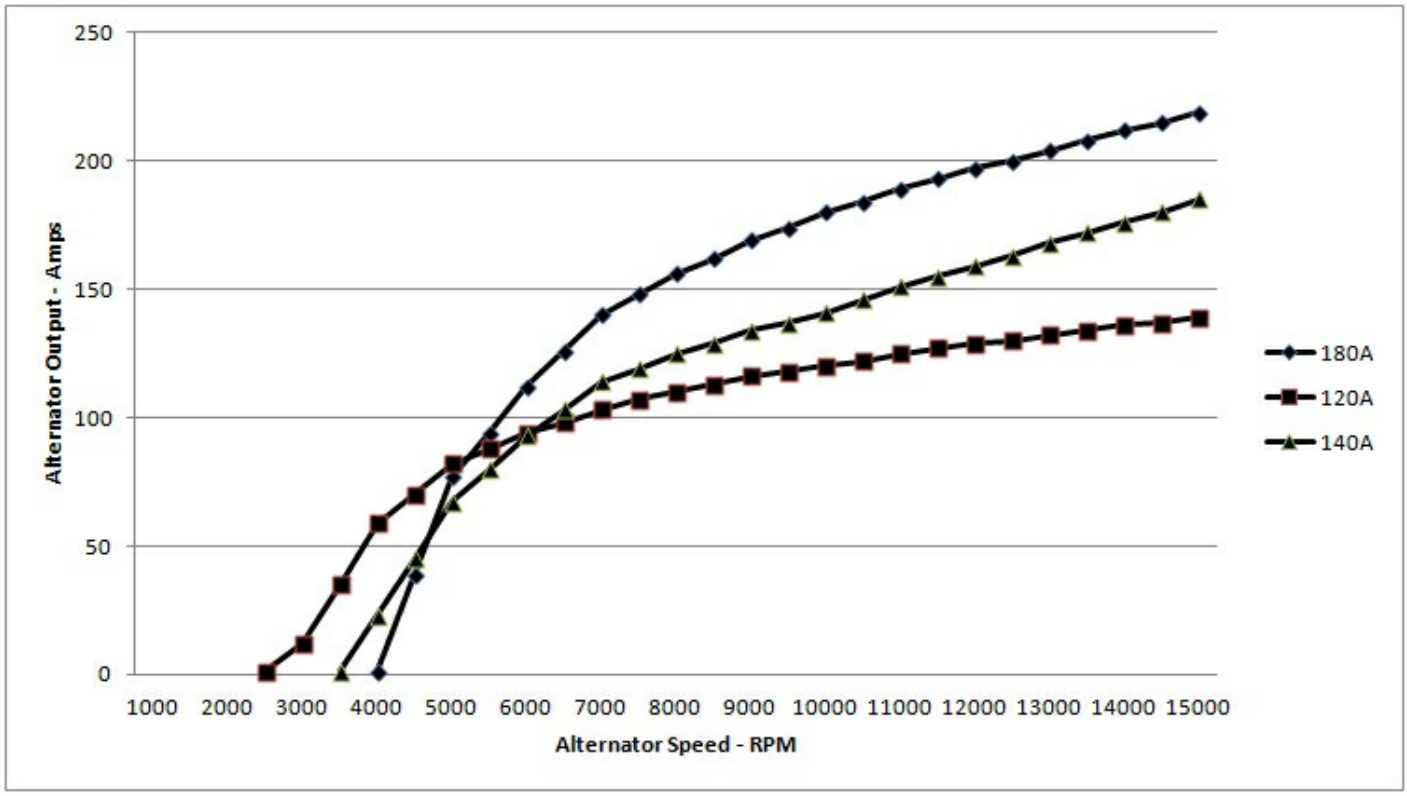
Output in Amps				
Nominal Current Rating		120A	140A	180A
Cut In Speed		2,500rpm	3,500rpm	3,500rpm
Speed (RPM)	2500	0	0	0
	3000	12	0	0
	5000	82	67	77
	7500	107	119	148
	100000	120	141	180
	125000	130	163	200
	15000	139	185	219

Images/Diagrams

180 Amp Clockwise Rotation



G-Type Alternator Power Curve



Ordercodes

Description	Ordercode
180 A Clockwise Rotation	O 030 650 005 116
140 A Anti-Clockwise Rotation	O 030 650 005 030
140 A Clockwise Rotation	O 030 650 005 062
120 A Clockwise Rotation	O 030 650 005 089

K-Type Alternator Up to 200Amps

The K-type alternator has a specially wound stator to achieve high power output in a small, low weight package. High current diodes are used in the rectifier and internal fans provide forced air cooling. The output is controlled by a regulator inside the alternator. The units are assembled with stiff brush springs and extra flexible wire to connect the stator to the rectifier. The stator is pegged to the body and all screws are locked. High quality bearings are used to enable the alternators to run at high speeds (up to 18,000 rpm). The standard mounting method is intended for a belt drive, but the alternator may also be driven directly, if required.

Please request our installation datasheet for further details.

In Detail

Electrical

- Output voltage 13.5V DC
- Nominal output current
-

High	200 Amp	Cut in speed 2500rpm
Medium	165 Amp	Cut in speed 2000rpm
Low	110 Amp	Cut in speed 1300rpm

- A detailed performance chart is shown on the next pageIgnition quiescent current 300mA*

Mechanical

- - Aluminium alloy body
  - Maximum speed 18000rpm
  - Clockwise or anti clockwise rotation available
  - Weight <4.9kg
  - Potted elastomer boot for strain relief of cable

  Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application.

  For example:

  - Through bored mounting holes

- High accuracy machining of mounting flanges
- Alternative cable entry locations
- Alternative connectors
- The regulator/rectifier unit may be rotated through 90°, 180° or 270°

Hard-wire back-up of the regulator is also available if requested.

Please contact our technical consultancy service who will be pleased to help

* If alternator is continuously connected to the battery this quiescent current draw may drain the battery

Connection Definition

- 22AWG cable (where fitted)
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Positive power output M8 stud (B+ terminal)
- Ground connection for power and regulator is through the case. Ensure that the case has a high current, low resistance connection to vehicle ground.
- Cable connection:
-

Green wire	Pin A	Pin 1	Ignition
Red wire	Pin B	Pin 2	Sense
White wire	Pin C	Pin 3	Lamp

- Single connection - The Ignition and Sense connections for the single connection alternators are through the power output stud (B+ terminal)

Environmental

- Splash resistant to standard motorsport fluids
- Viton jacketed cable
- Continuous ambient operating temperature -30 to +90°C
- Maximum ambient temperature 110°C short term, providing the following temperatures are not exceeded:
-

Stator	200°C
Diodes	175°C
Regulator	115°C
Bearings	150°C

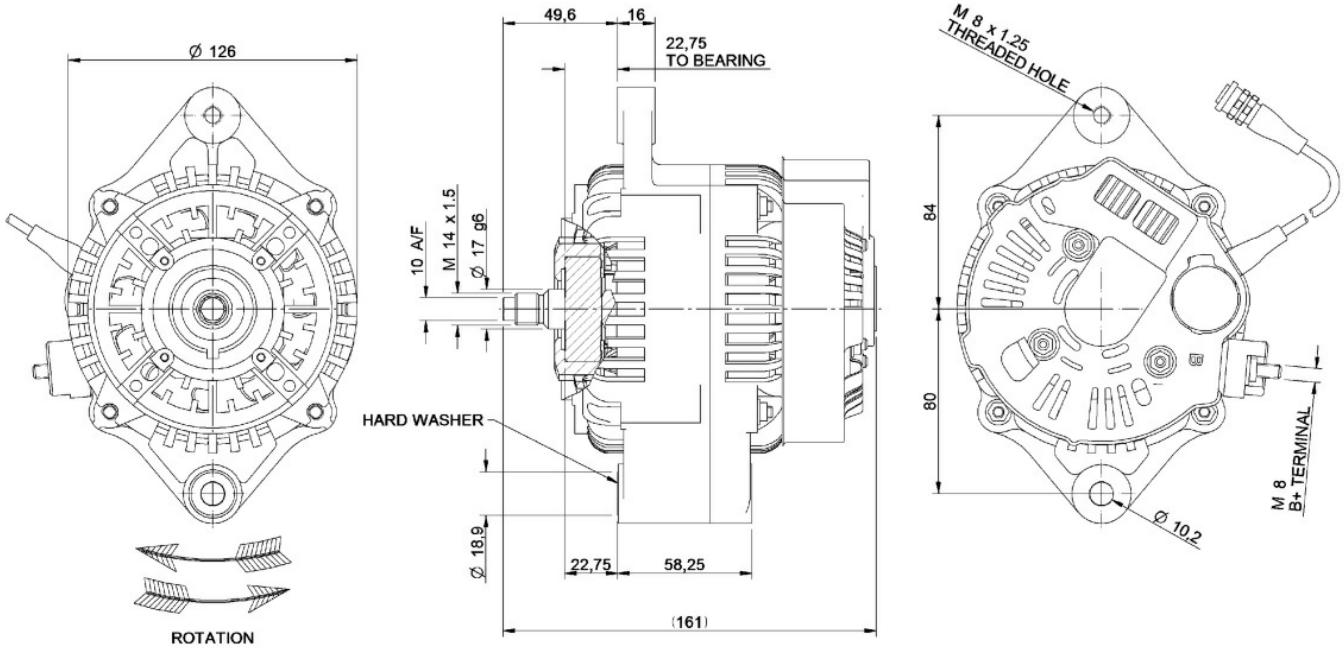
Power Curve

Output in Amps			
Nominal Current Rating	Standard 110A	Medium 165A	High 200A

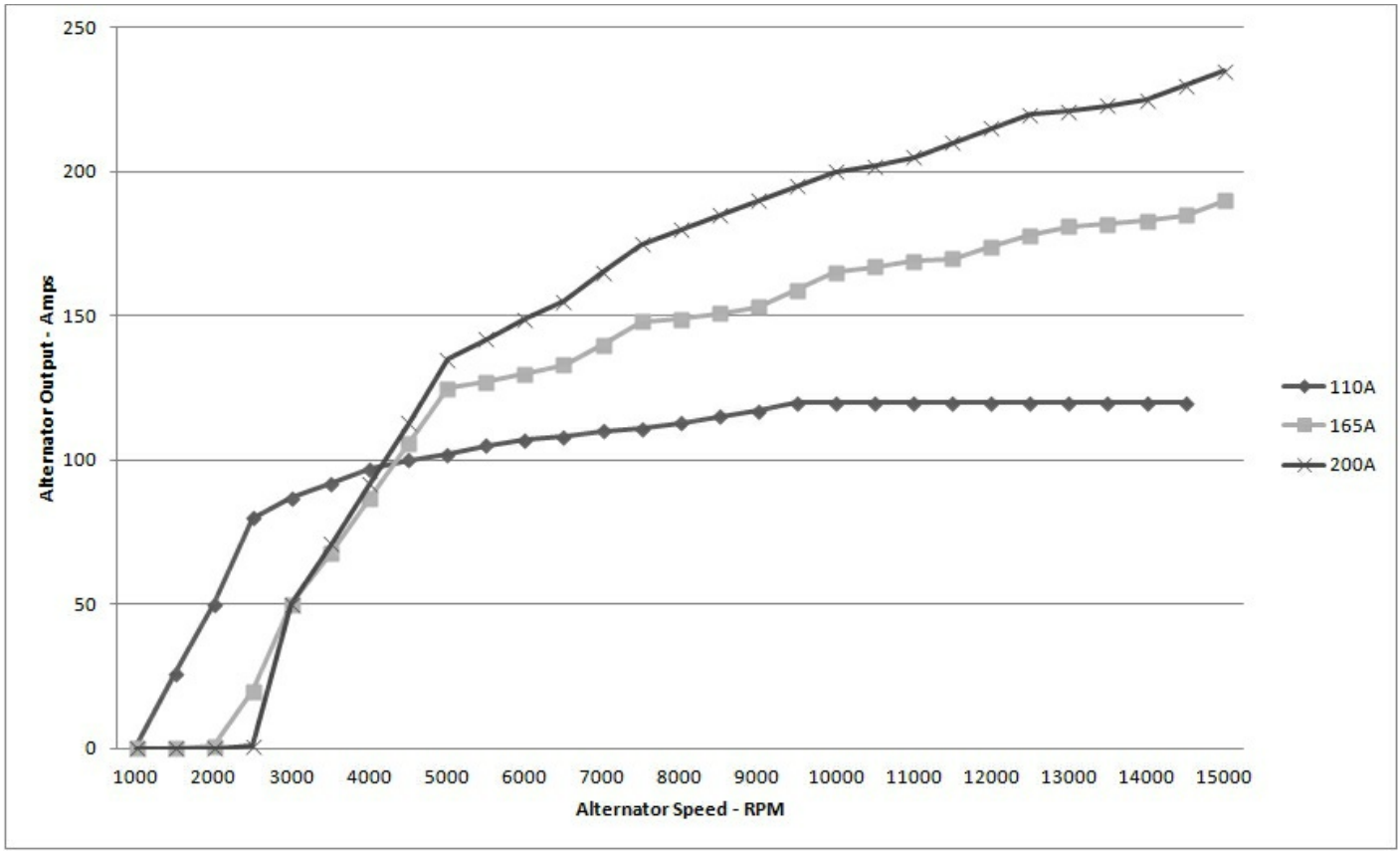
Cut in Speed		1300rpm		2000rpm		2500rpm	
Ambient Temperature		25°C (@13.5V)	90°C (@12.5V)	25°C (@13.5V)	90°C (@12.5V)	25°C (@13.5V)	90°C (@12.5V
Speed (rpm)	2500	60	50	20	27	0	0
	3000	80	70	50	55	45	50
	5000	100	90	125	123	135	125
	7500	110	90	148	140	175	155
	10000	120	90	165	147	200	180
	12500	120	90	178	157	220	190
	15000	120	90	190	170	235	200

Images/Diagrams

K Type Alternator



K-Type Alternator Power Curve



Ordercodes

Description	Ordercode
110 Amp Clockwise Rotation	O 030 650 013 017
165 Amp Clockwise Rotation	O 030 650 013 000
200 Amp Clockwise Rotation	O 030 650 013 001
110 Amp Anti-clockwise Rotation	O 030 650 013 051
165 Amp Anti-clockwise Rotation	O 030 650 013 019
200 Amp Anti-clockwise Rotation	O 030 650 013 004

NASCAR Alternator NASCAR 140A Alternator

Our alternators provide 140A in a 7lb package.

The alternator has a specially wound stator to yield a small, low weight package. An uprated rectifier assembly and internal fans minimize internal heating. The output is controlled by a solid state regulator inside the alternator. Stiff brush springs, the rectifier, a pegged stator and high quality bearings are used to ensure reliable operation at speeds up to 18,000 rpm. The standard mounting method is intended for a belt drive, but the alternator may also be driven directly, if required.

Please request our installation datasheet for further details.

In Detail

Electrical

- Output voltage 13.5V DC
- Nominal output current 140A, cut in speed 3500rpm

A detailed performance chart is shown on the next page

Mechanical

- Aluminium alloy body
- Maximum speed 18000rpm
- Clockwise or anti clockwise rotation available
- Weight <7.32lb

Anti-Vibration Features

- Enhanced rectifier with M8 B+ terminal implemented in 2006
- Rectifier has integral machined straps
- B+ terminal support
- Additional diode leg welding on rectifier
- Regulator has flexible internal back-up connection

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application.

For example:

- Through bored mounting holes
- High accuracy machining of mounting flanges
- Alternative cable entry locations
- Alternative connectors
- The regulator/rectifier unit may be rotated through 90°, 180° or 270°

Connection Definition

{u'body': u'

- Splash resistant to standard motorsport fluids
  \r\n
- Viton jacketed cable
  \r\n
- Continuous ambient operating temperature -30 to +90\xb0C
  \r\n
- Maximum ambient temperature 110\xb0C short term, providing the following temperatures are not exceeded:
  \r\n
-

Stator	200\xb0C
Diodes	180\xb0C
Regulator	115\xb0C
Bearings	150\xb0C

', u'title': 'Environmental'}

Alternator RPM

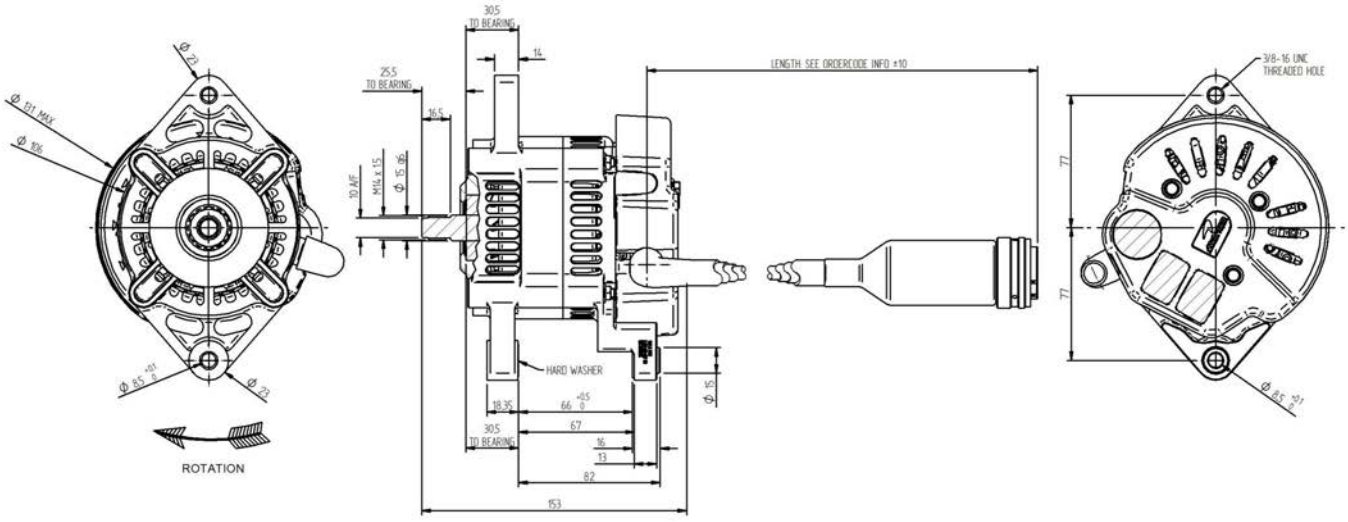
Output in Amps (@13.5V)			
Nominal Current Rating		**140A**	
Ambient Temperature		**25°C**	**90°C**
Cut In Speed		**3500rpm**	**3600rpm**
	3500	0	0
	4000	23	15
	5000	67	59
	6000	93	82
	7000	114	98

Speed (rpm)	8000	125	111
	9000	134	117
	10000	141	126
	11000	151	132
	12000	159.5	140
	13000	168	145
	14000	176.5	152
	15000	185	168

Images/Diagrams

O 030 650 005 043

G-Type NASCAR Alternator (140Amp)



Ordercodes

Description	Ordercode
Single connection High Output G Type	O 030 650 005 043

Permanent Magnet Alternator Permanent Magnet

Permanent magnet alternators can tolerate high ambient temperatures and vibration allowing them to be directly mounted to racing engines. The separate regulator can be mounted in a location where the temperatures and vibration levels are lower. When used together with the DC2 “Buck” regulator, the alternator provides high current, at stable voltage, over a large range of rotation speeds from a very small and lightweight package.

In Detail

Application

- Single-seat racing cars and motorcycles.

Electrical

- Output three-phase alternating current
- Rectified output current when used with a DC2 regulator 25A (typ.), 30A (max*
- Rectified output current when used with a DC3 regulator 55A (typ), 60A (max)
- Frequency 750Hz on each phase at 15000rpm

A detailed performance chart is shown at the end of this product summary.

*An output of 40A can be achieved with special cooling

Environmental

- Splash resistant to standard motorsport fluids
- Maximum humidity 100%
- Maximum temperature:

Stator	220°C (250°C short term)
Bearings	170°C
Rotor	150°C

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Maximum speed 18000rpm
- Bi-directional rotation

- Rotor balanced to
- Spline to NF-E22-144, Major dia. 9.48mm. Other splines of similar diameter can be provided
- Weight, including cable, is shown on the order details.

Design and manufacture is in-house, so if our existing designs do no suit your application, we can provide cost effective customised parts to suit even the most demanding application. We can provide special mounting and shaft arrangements and can optimise the output characteristics to suit your application. Please contact our technical consultancy service who will be pleased to help.

Connection Definition

- 55 spec 22AWG cable (four wires for each phase)
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection:
-

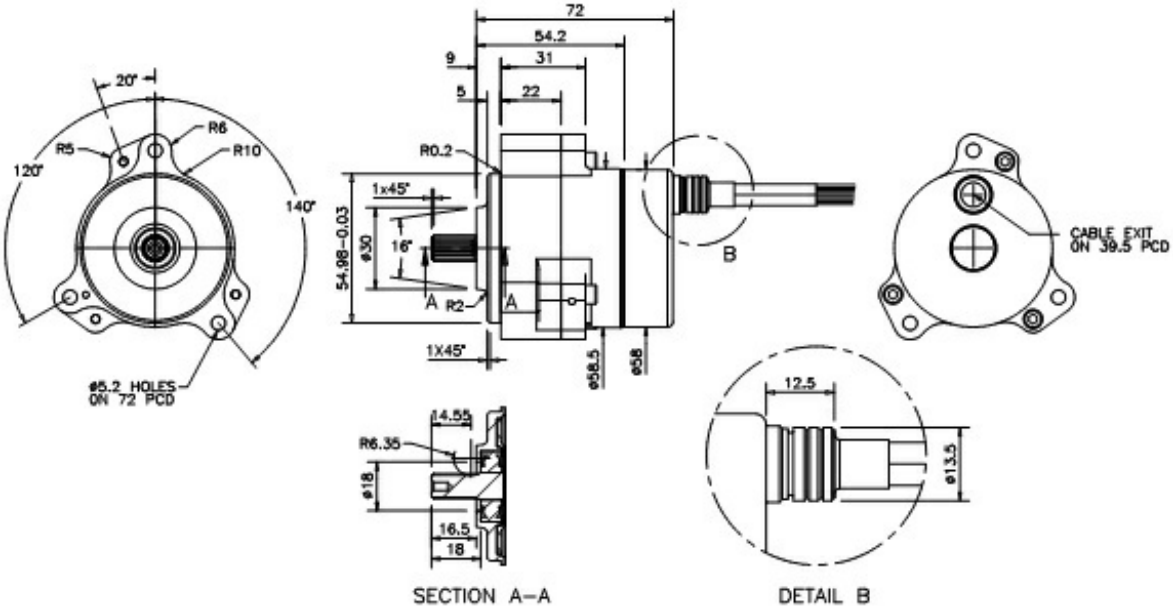
Red wires (4)	Phase 1
Green wires (4)	Phase 2
White wires (4)	Phase 3

Phases are interchangeable

Images/Diagrams

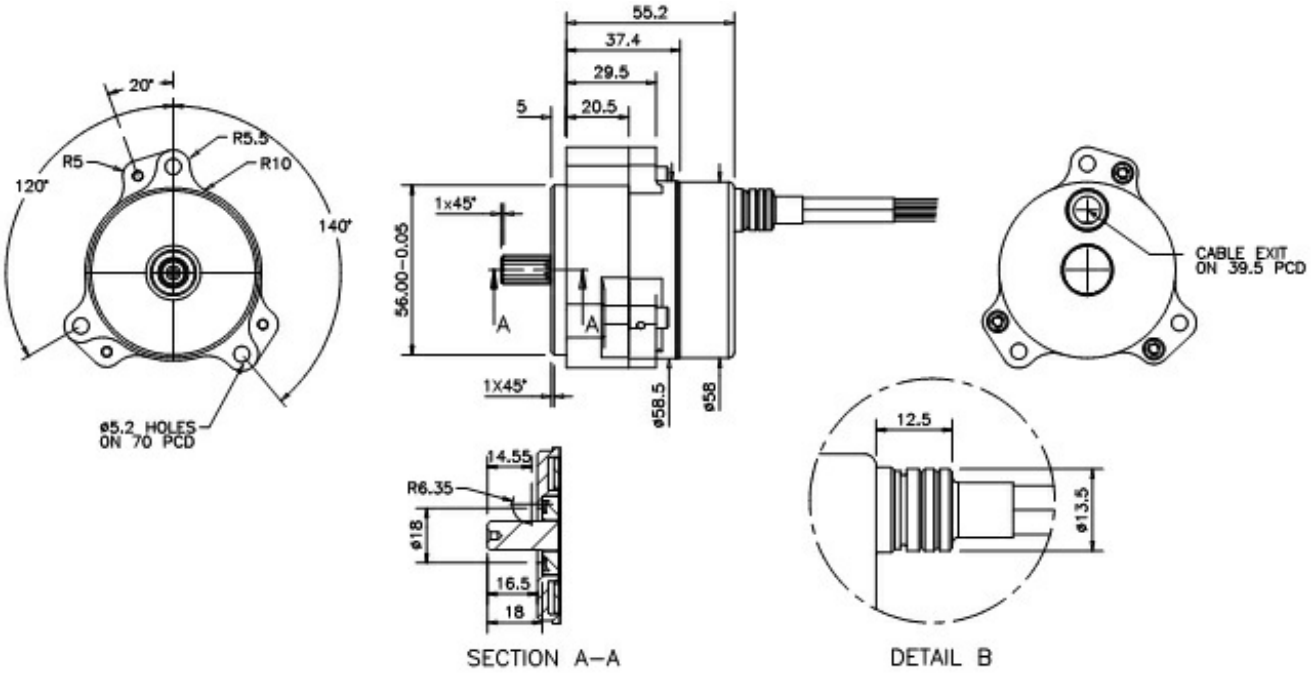
Standard Length

O 030 650 017 000



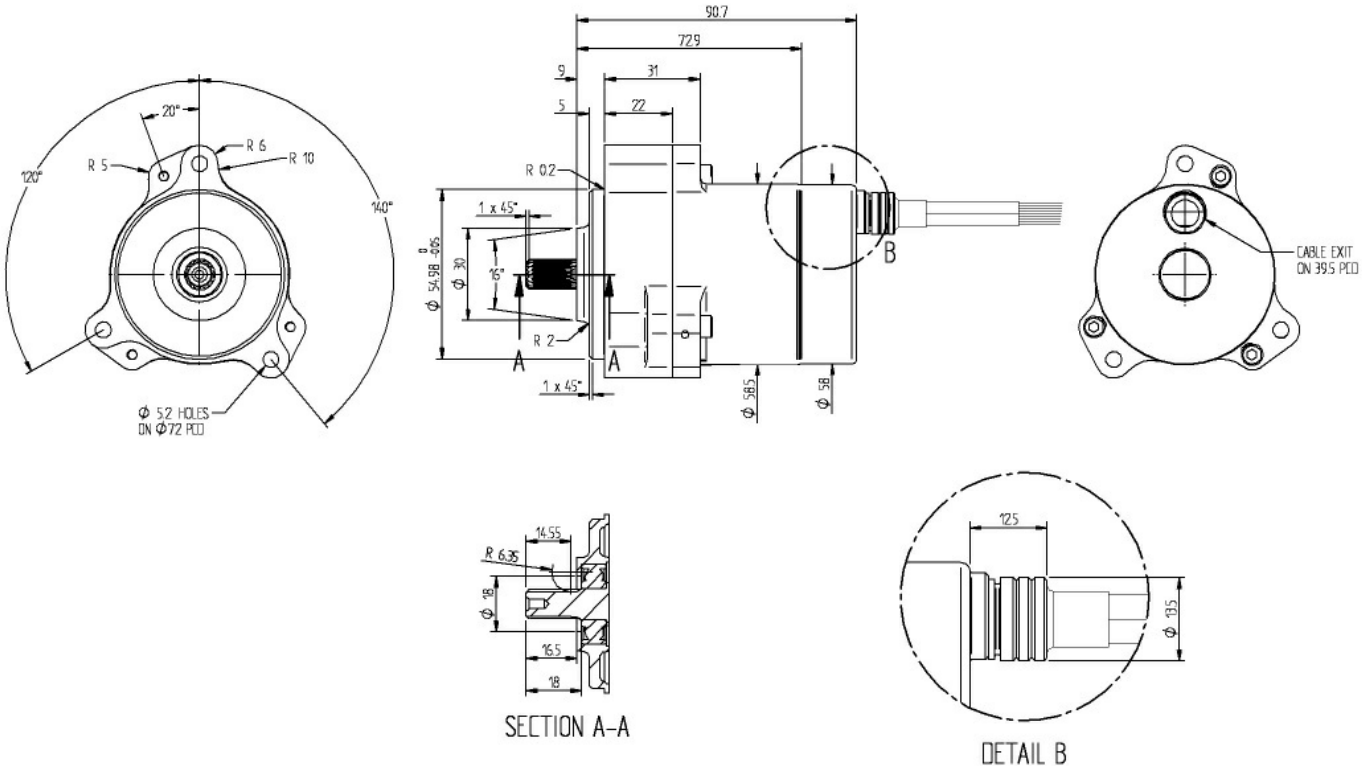
Short Length

O 030 650 017 011



60 Amp

O 030 650 017 035



Ordercodes

Description	Ordercode
Standard Length	O 030 650 017 000
Short Length	O 030 650 017 011

Description	Ordercode
60 Amp	O 030 650 017 035

SMART Alternator

G-Type Alternator with CAN Communications

This alternator has a specially wound stator to achieve high power output in a small, low weight package. High current diodes are used in the rectifier and internal fans provide forced air cooling. The output is controlled by a regulator inside the alternator and is configurable over the CAN interface. The units are assembled with stiff brush springs and extra flexible wire to connect the stator to the rectifier.

The stator is pegged to the body and all screws are locked. High quality bearings are used to enable the alternators to run at high speeds (up to 18,000rpm). The standard mounting method is intended for a belt drive, but the alternator may also be driven directly, if required.

In Detail

Electrical

- Output voltage 14.3V DC default, configurable over range 11V to 16V DC
- Nominal output current at 10,000 RPM at 13.3V, see performance chart

Mechanical

- Weight <3.2kg
- Aluminium alloy body
- Billet aluminium rear cover
- Maximum speed 18,000rpm
- Strapped rectifier

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application.
Please contact our technical consultancy service who will be pleased to help.

CAN Communications Interface

- Voltage set point configuration
- On/Off control
- Diagnostic information, including:
    - Regulator and Rectifier Temperatures
    - Output Voltage Measurement

- Over-Current Warning
- RPM measurement

Connection Definition

- 22AWG un-screened cable
- Viton jacketed cable
  - Positive power output M8 stud (B+ terminal)
  - Ground connection for power and regulator is through the case. Ensure that the case has a high current, low resistance connection to vehicle ground
  - Cable Connection

Pin 1	Green wire	Ignition
Pin 2	Red wire	Sense
Pin 3	White wire	Lamp
Pin 4	Yellow	CAN+
Pin 5	Blue	CAN-

- Alternative connection details: Ignition and sense connections are through the power output stud (B+ terminal), no lamp connection, CAN as above.

Environmental

- Splash resistant to standard motorsport fluids
- Continuous ambient operating temperature -30 to +90°C
- Maximum ambient temperature 110°C short term. Providing the following temperatures are not exceeded:

Stator	200°C
Diodes	175°C
Regulator	105°C
Bearings	150°C

Alternator Output

180A G-Type Alternator Output

		Typical Maximum Output (Amps)		
Output Voltage		**11V[1]**	**14.3V**	**16V[1]**
Cut In Speed (RPM)		<4000		
Speed RPM	4000	65	50	45

	5000	124	95	85
	6000	169	130	116
	7000	200	154	138
	8000	220	169	151
	9000	237	182	163
	10000	250	192	172
	11000	260	200	179
	12000	267	205	183

[1] The current at 11V and 16V are calculated values.

140A G-Type Alternator Output

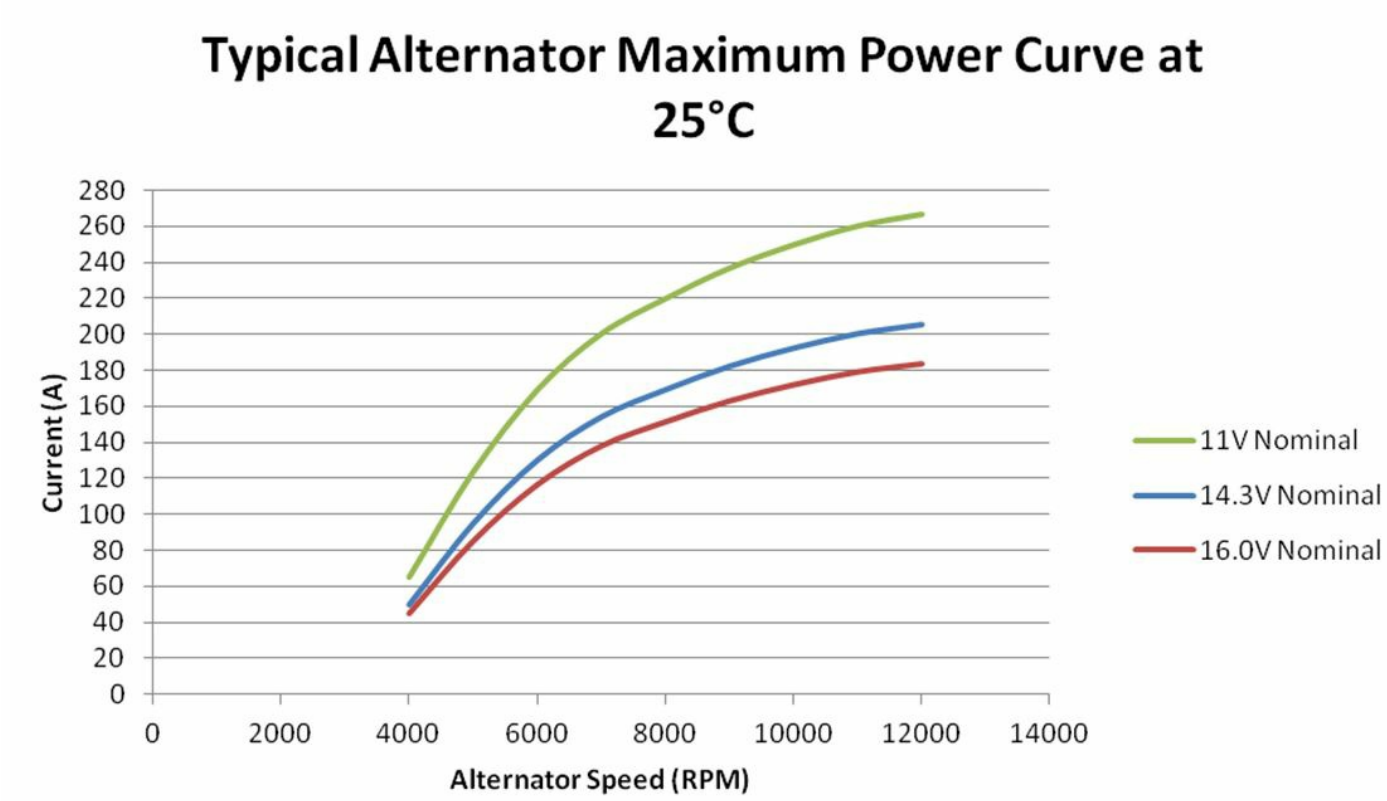
		Typical Maximum Output (Amps)		
Output Voltage		**11V[1]**	**14.3V**	**16V[2]**
Cut In Speed (RPM)		<3500		
Speed RPM	4000	57	44	39
	5000	116	89	80
	6000	150	115	103
	7000	173	133	119
	8000	189	145	130
	9000	202	155	139
	10000	213	164	147
	11000	221	170	152
	12000	228	175	156

[1] The currents at 11V and 16V are calculated values.

Images/Diagrams

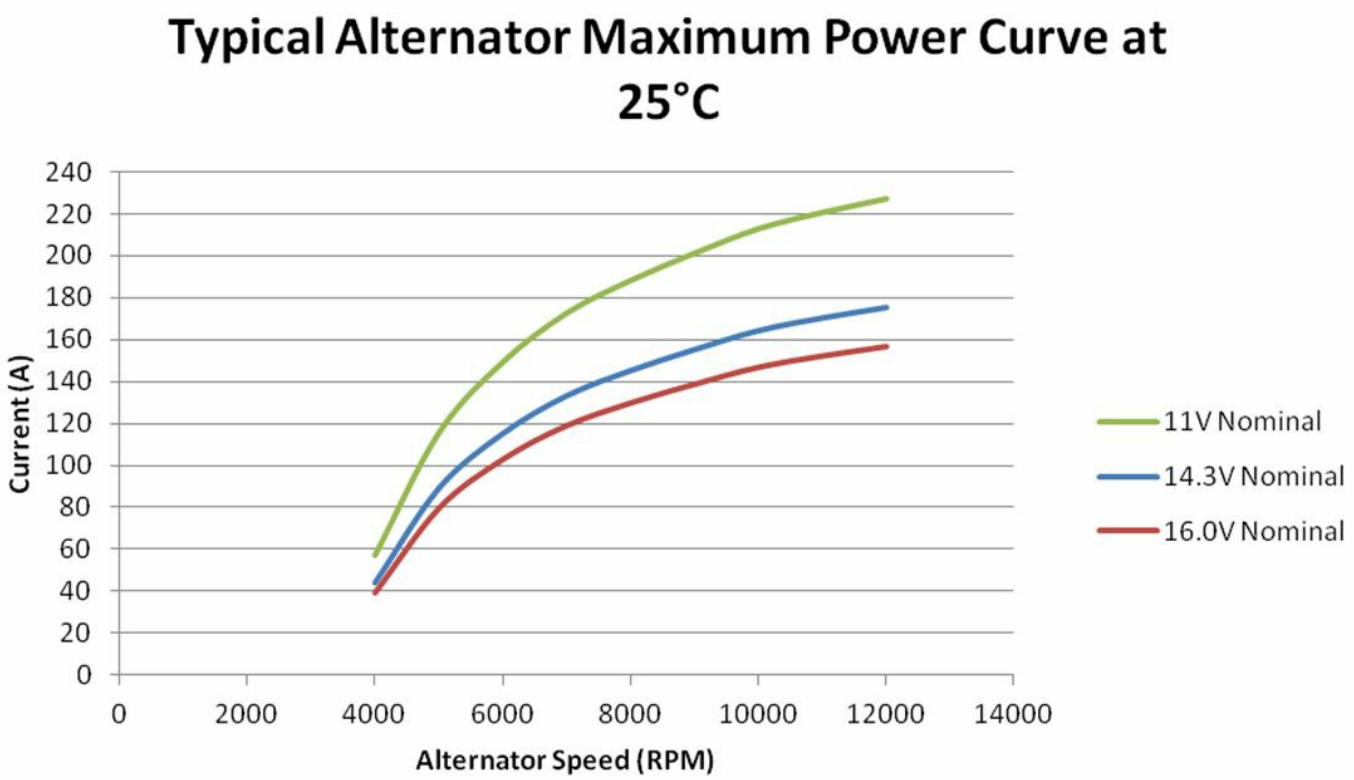
180A Output Power Cuve

Typical Alternator Maximum Power Curve at 25°C

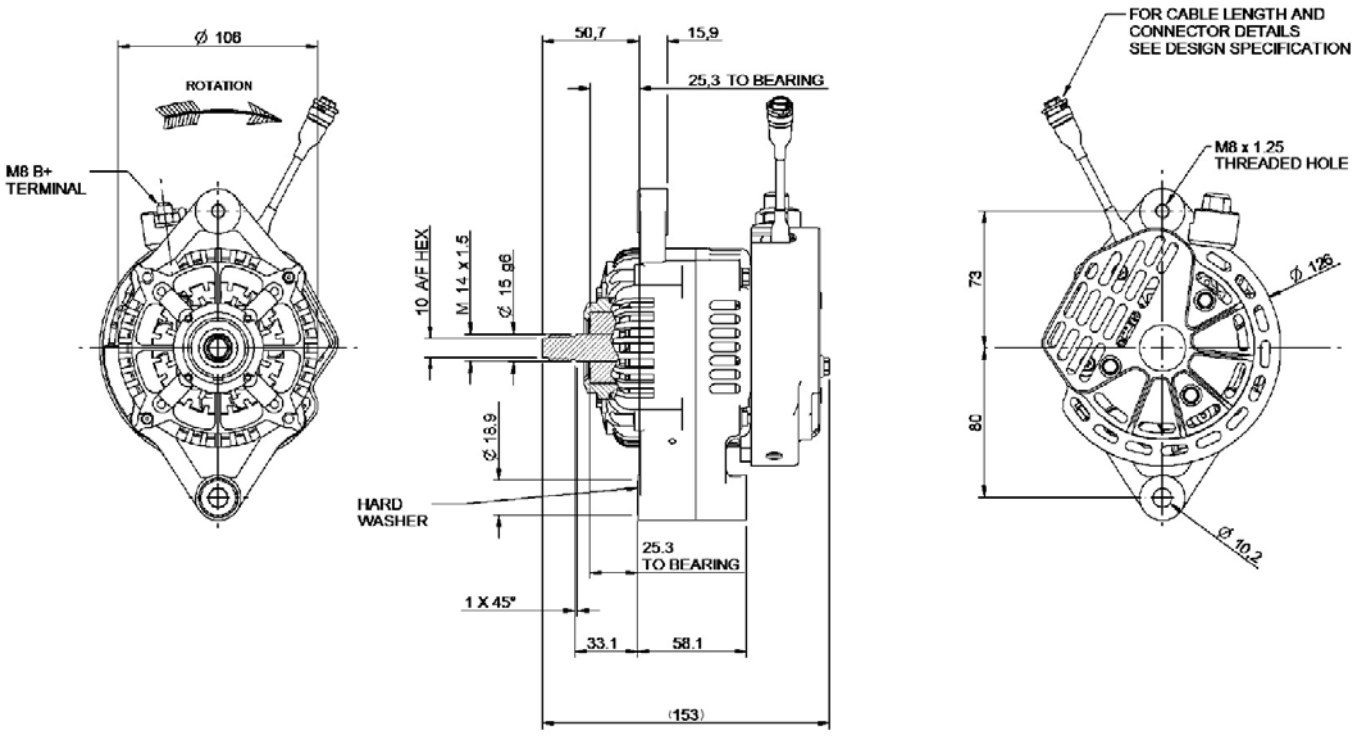


140A Output Power Curve

Typical Alternator Maximum Power Curve at 25°C



G-Type alternator Dimensions



Ordercodes

Description	Ordercode
180A Output, Clockwise rotation	O 030 650 034 000

Description	Ordercode
180A Output, Anti-Clockwise rotation	O 030 650 034 006
140A Output, Clockwise rotation	O 030 650 034 001
140A Anti-Clockwise rotation	O 030 650 034 005

VR-85 VR-85

This unit uses a switchmode converter to provide a regulated DC rail at 14V from a 3-phase permanent magnet alternator input.

In Detail

Application

- Single seat racing cars

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. Please contact our technical consultancy service who will be pleased to help.

Electrical

- Stabilised Output Voltage:
  14.35±0.2V at 0A
  14.10±0.2V at 85A
  when measured at 25°C at the unit's connector
- Switchable Output
- Current Output 85A (max), for peak phase to phase voltage 100 to 180V
- Output impedance 10m□(typ)
- Three phase alternator power input
- Input peak phase to phase voltage from the alternator, absolute maximum 200V
- Input current not to exceed 25A rms per phase
- Alternator phase DC resistance must exceed 150m□
- Minimum current load for normal regulation 0.5A
- Minimum input peak phase to phase voltage for normal regulation 15V
- Temperature output :
  KTY82-210 temperature sensor with 3.4k□ pull up to 5.00V
  Transfer function:
  Temperature (°C) = Vout x 114.9-187.3 ±1.5°C Error typ for 0°C to 100°C
- Current sensor measures the 14V supply current.

Vout at 0A = 0.523±0.15V

Vout at 85A = 4.542±0.15V

Mechanical

- Case material: HE30 aluminium alloy hard anodised and dyed black
- Weight less than 1300g TBC

Environmental

- Splash resistant to standard motorsport fluids
- Lids and screws sealed with silicone rubber
- Internal Temperature not to exceed 70°C as measured by internal diagnostic sensor – care should be taken to prevent overheating if absolute max power demand (1220W) sustained for a long period.
- Minimum operating temperature 0°C
- Forced cooling required over fins and side walls
- Storage Temperature -25°C to +85°C

Connection Definition

- Connector:

Integral, sealed, military standard connector

Output Connector : AS0-16-35SN 55 way

Function	Pin no.
14V (27 pins)	29-55
Gnd (28 pins)	1-28

Input/Diagnostic Connector : AS0-12-35PN 22 way

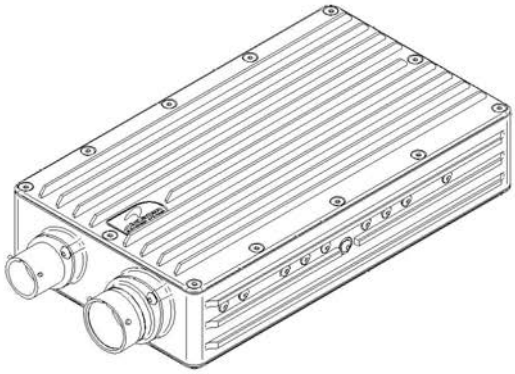
Function	Pin no.
Output control line	14
Current sensor output	13
Temperature sensor output	12
Reference Gnd for temp and current sensor outputs	11
Phase 1 (5 pins)	8, 9, 10, 18, 19
Phase 2 (5 pins)	4, 5, 6, 7, 17
Phase 3 (5 pins)	1, 2, 3, 15, 16

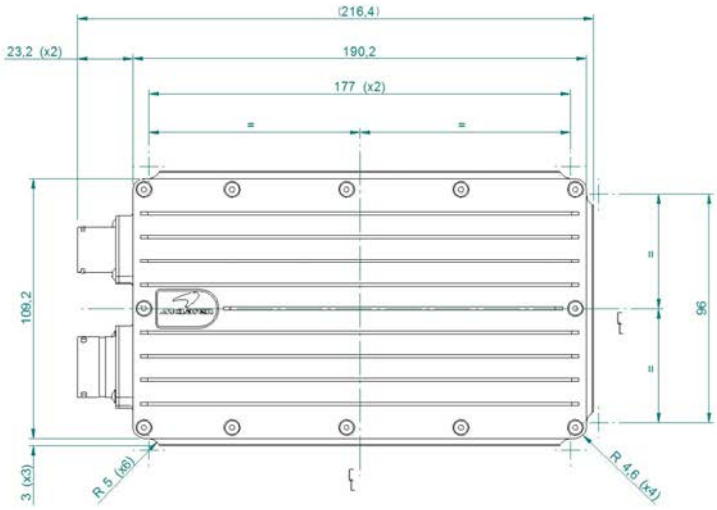
The output is switched OFF by connection the output control line to ground. Output is switched ON when the output control line is floating or connected to a voltage greater than 2V. Ensure that the output is switched ON during power up.

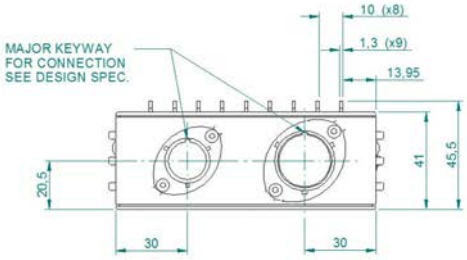
Images/Diagrams

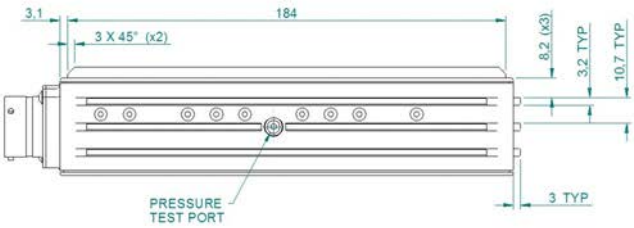
O 030 650 020 010

85A Voltage Regulator









Ordercodes

Description	Ordercode
85A Voltage Regulator	O 030 650 020 010

Hybrid & EV

E-Motor 120kW / 130Nm

The 120kW E-Motor is a synchronous permanent magnet motor/generator primarily intended for hybrid and electric vehicles. The unit is powered via a high voltage three-phase electrical connection from an inverter, such as McLaren Applied Technologies' MCU-500.

An advanced liquid cooling scheme allows the motor to achieve sustained high power operation given the unit's modest size and weight.

When combined with the MCU-500, and powered from a 535V DC bus, the unit can be controlled via torque and/or speed demands via a CAN bus. The same performance characteristics can be achieved in motor and generator modes of operation.

In Detail

Key Features

- Permanent magnet synchronous motor
- SPM type
- High power density

Performance

  - 120kW / 130Nm (transient)
  - 110kW / 110Nm (continuous)

- Maximum speed 17,000rpm
- Efficiency 96% (120kW, 13,000rpm)

Electrical

- Input type: high voltage sinusoidal three-phase
- Nominal bus voltage 545V
- Maximum bus voltage 630V
- Minimum bus voltage 420V (for full performance)
- Leakage current <15mA

Mechanical

- Case diameter 185mm
- Case length 254mm

- Mass 26kg

Instrumentation and Diagnostics

- One Resolver for commutation

Cooling

- Max inlet temperature 55°C
- Min flow-rate 20l/min
- Pressure drop 0.6bar @ 20l/min
- Coolant type 50/50 water/glycol
- Max pressure 5bar

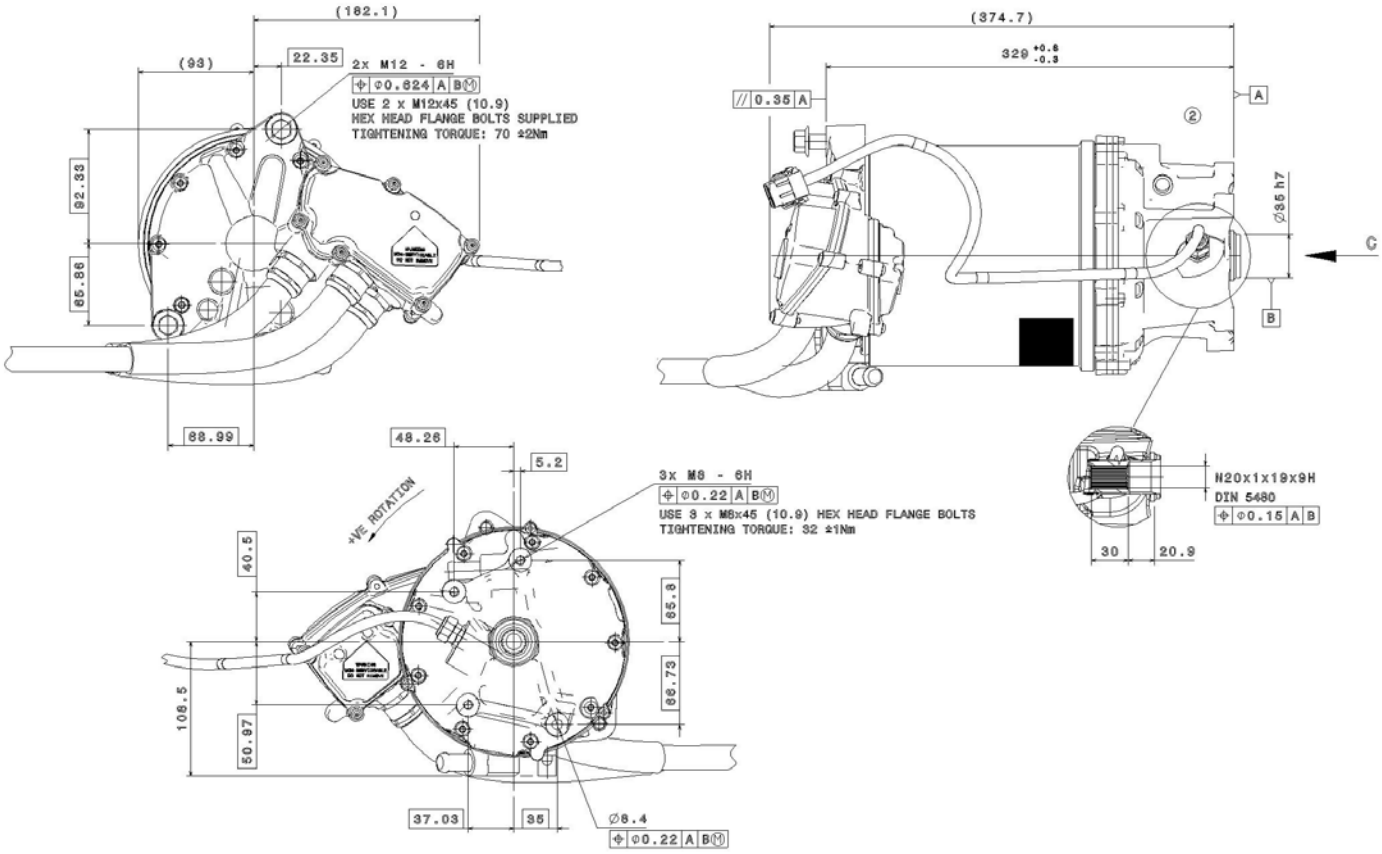
Environmental

    - -20°C to 90°C (operating)
    - -20°C to 120°C (static)

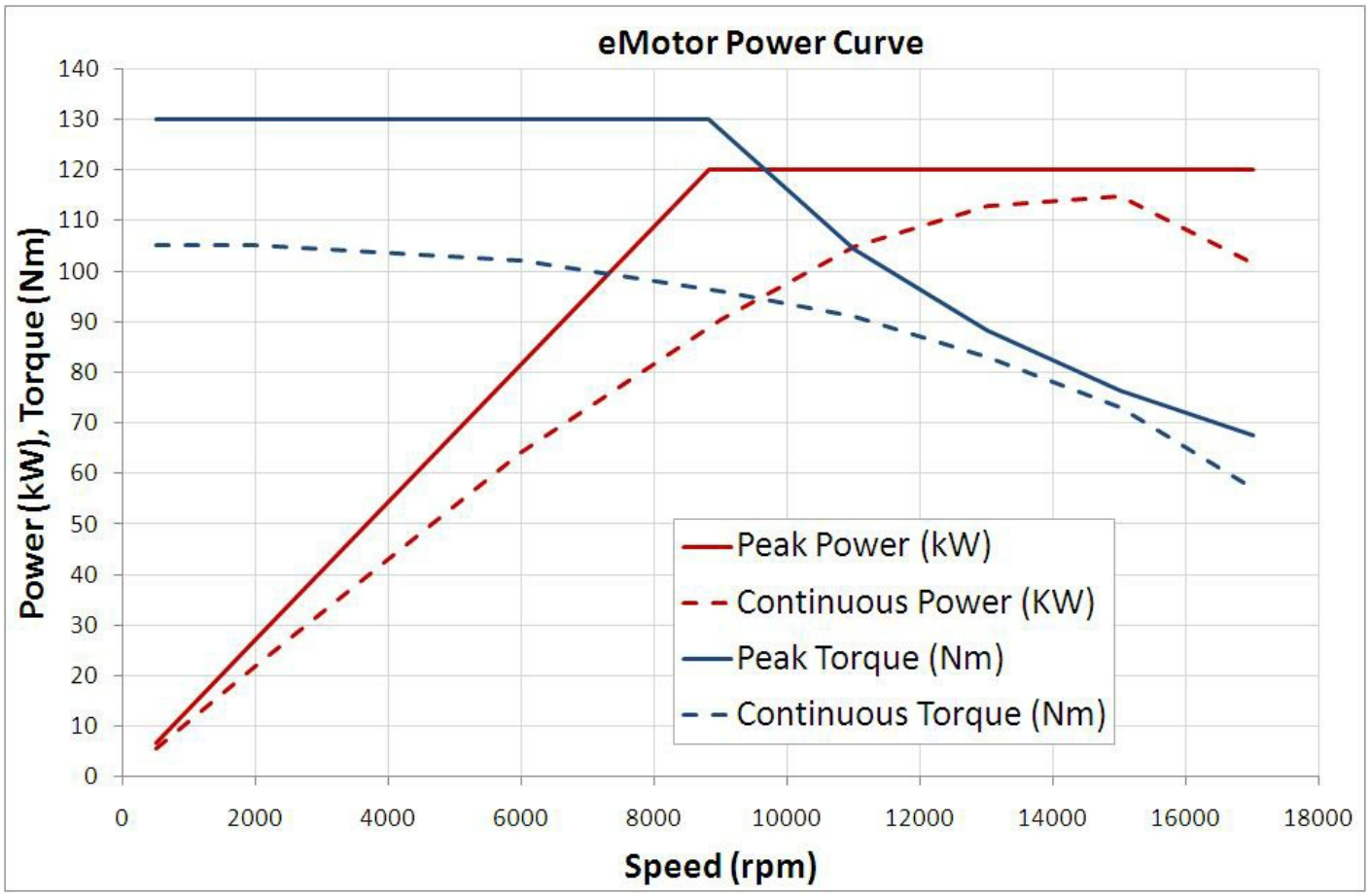
- Max motor skin temperature 65°C
- Rated to IP67
- Maximum mounting vibration 30g
- Complies with the essential protection requirements of 89/336/EEC

Images/Diagrams

E-motor



E-Motor Power Curve



Ordercodes

Description	Ordercode
E-Motor-120kW	O 030 525 000 001

Motor Control Unit MCU-500 / MCU-510

The MCU-500 is a combined inverter and DC/DC converter for use in hybrid and electric vehicles, suitable for both automotive and motorsport applications. Permanent magnet synchronous motors of surface or interior types are supported.

A high DC bus voltage coupled with liquid cooling allows for high motor power in a very compact and lightweight unit. The unit is self contained, and designed to be sited adjacent to a high voltage battery assembly. Output terminals provide the high current electrical connection to the motor.

Full synchronous closed-loop motor control is provided, with a target torque demand being received from the vehicle's electronic control unit through a CAN interface.

This unit is designed and manufactured in-house. Bespoke variants can be provided to suit customer requirements.

In Detail

Key Features

- Low volume and mass to power ratio
- High power capability
    - SPM – supported
    - IPM – supported
- Torque demand supplied through vehicle CAN link
- Delivered torque derived from motor currents and transmitted through vehicle CAN link
- Field weakening supported
- Separate supervisor processor included for safety
- Capacitive discharge circuit included

Electrical

- Supply voltage 8-16V

Inverter

- Maximum current 500A rms
- Maximum DC bus voltage 700V
- DC bus input capacitance 232uF

- Switching frequency 16kHz (switches to 8kHz at low motor speeds)

DC/DC Converter

- Maximum current 250A
- Output voltage 12-16V (selectable via CAN)

Internal Diagnostics

- One DC link voltage
- One DC link current
- Three Phase current
- Six Inverter temperatures
- Two cold plate temperature

Communications

- Vehicle interface (500kbps)
- XCP interface (1Mbps)
- Motor control monitoring interface (1Mbps)

  Sensor Inputs
- 2 Pt1000 (-50°C to 250°C)
- 1 Resolver

- Vehicle CAN message protocol defined according to customer requirements

Cooling

- Max inlet temperature 55°C
- Min flow-rate 20l/min (to achieve rated specification)
- Pressure drop 0.5bar
- Coolant type 50/50 water/glycol
- Max pressure 5bar

Mechanical

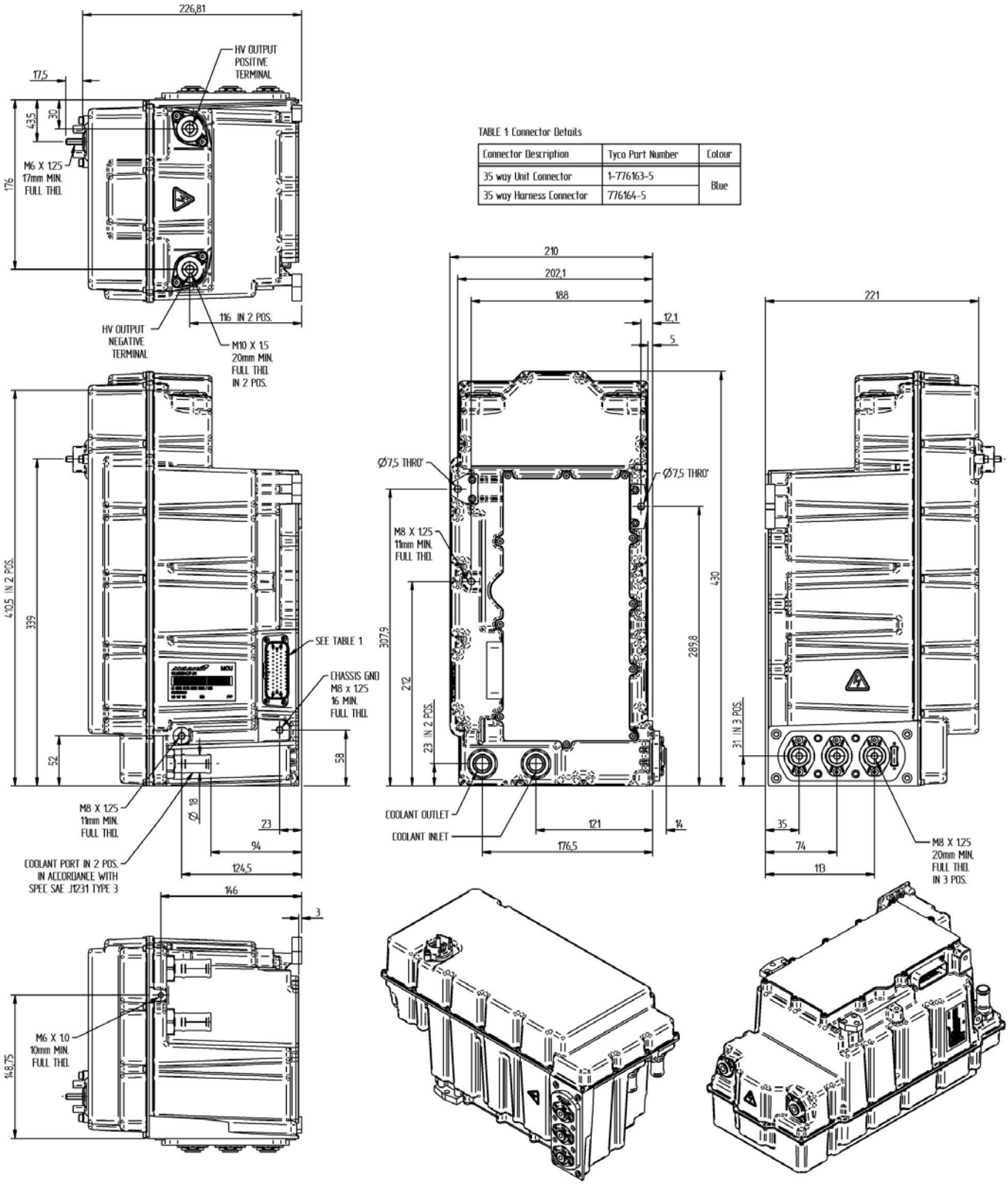
- Volume 16litre
- Mass 15.8kg
- Dimensions 430mm x 201mm x 214mm

Environmental

- Rated to IP66
- MCU-500 (Automotive specification) meets Automotive Standard REG 2004/101/EC
- MCU-510 (Motorsport specification) complies with the essential protection requirements of 89/336/EEC

Images/Diagrams

MCU-500



Ordercodes

Description	Ordercode
MCU-500 – Automotive Applications	O 030 072 022 000

Description	Ordercode
MCU-510 – Motorsport Applications	O 030 072 022 001

Ignition Coils

CDI Ignition Coil Capacitive Discharge Ignition

An on-plug coil for use with Capacitive Discharge Ignition (CDI). Design and manufacture is in-house, so we can make the coil to suit your specific application. The information given here is for a typical coil. Many of the parameters can be tailored to a particular installation.

Please contact our technical consultancy service to discuss your requirements.

In Detail

Application

- Capacitive discharge ignition systems.

Electrical

Typical measurements at 25°C (except where stated otherwise)

- Primary DC resistance 800 to 1000mohm
- Primary inductance 252 to 332µH

The following measurements are made with a power unit consisting of a 0.33µF capacitor, charged to 460V (35mJ) supplying the coil with a peak primary current of 35A. The coil is mounted in an aluminium block to simulate a cylinder head.

- Secondary high voltage (fired off-load*) 26kV typ
- Secondary energy discharged into 2nF load 20mJ typ
- Burn time of open spark > 50µs (burn threshold 100V, at atmospheric pressure)

* Firing the coil off-load should be avoided as it can cause cumulative damage by electrical breakdown.

Cable and Connection Definition

- 22AWG un-screened cable
- Any cable length is available on request
- Various automotive and military standard connectors are available
- Connection
-

Red wire	Pin A	Pin 1	Primary Switched

Green wire	Pin B	Pin 2	Primary Non Switched
White wire	Pin C	Pin 3	Secondary return

Connect the primary so that “Primary Switched” is negative with respect to “Primary Non Switched” during discharge. The spark plug centre electrode discharge will be negative with respect to ground. The “Secondary Return” allows an ECU to measure the secondary current to confirm proper operation.

Mechanical

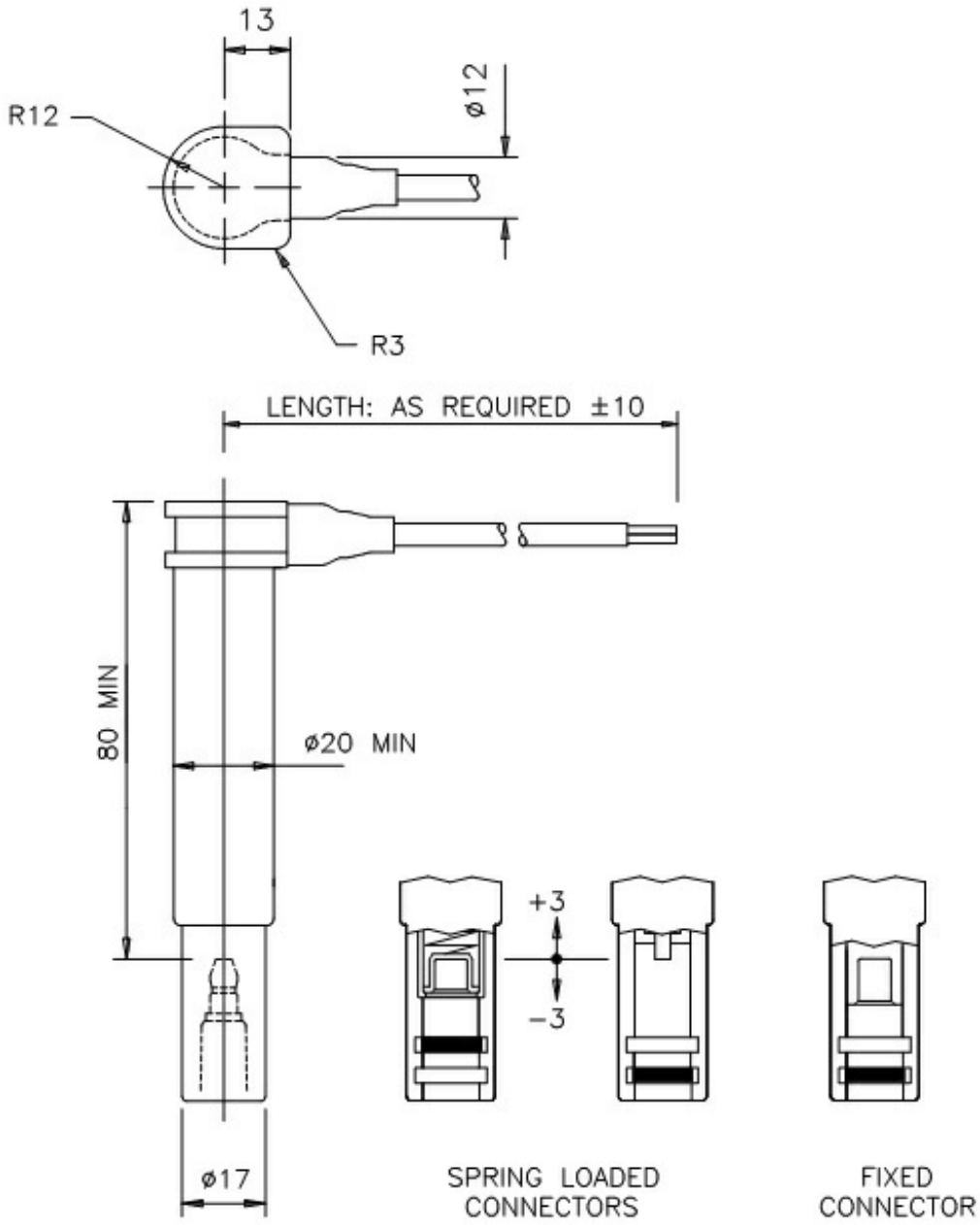
- Polyester body
- Minimum diameter 20mm
- Minimum length from top of coil to top of spark plug 80mm
- The body can be made longer and/or wider to suit a specific installation
- HT connection plunger travel 3mm. A fixed HT contact can be provided
- Axial clamping force 35 to 45N
- Weight less than 130g (including 1000mm cable)
- Elastomer boot for strain relief to the coil body
- Fluoro silicone boot or o-rings to seal spark plug

Environmental

- Resistant to standard motorsport fluids
- Operating temperature 0 to +150°C
- Maximum temperature +180°C for 10mins (coil not firing)
- Viton jacketed cable
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Images/Diagrams

CDI Coil



Ordercodes

Description	Ordercode
Please contact our technical consultancy service to discuss your requirements	O 030 XXX XXX XXX

Ignition Coil Transistorised Ignition

An on-plug coil for use with high current transistorised (inductive) ignition (TSI) as available in all our ECUs. Design and manufacture is in-house, so we can make the coil to suit your specific application. The information given here is for a typical coil. Many of the parameters can be tailored to a particular installation.

Please contact our technical consultancy service to discuss your requirements.

In Detail

Electrical

Typical measurements at 25°C (except where stated otherwise)

- Primary DC resistance 270 to 295mohm
- Primary inductance 115 to 135µH

The following measurements are made with a power unit operating at 7 to 16V supplying 20A* with the primary voltage clamped between 350 and 500V and the current collapsing at >5.5A/µs. The coil is mounted in an aluminium block to simulate a cylinder head.

- Secondary high voltage (fired off-load**) 26kV typ at 25°C
- Secondary energy*** into 2nF load 20mJ typ
- Burn time*** of open spark > 650µs (burn threshold 100V, at atmospheric pressure)

Cable and Connection Definition

- 20AWG un-screened cable
- Any cable length is available on request
- Various automotive and military standard connectors are available
- Connection
-

Black wire	Pin A	Pin 1	Primary Switched
White wire	Pin B	Pin 2	Primary Non Switched

Connect the primary so that “Primary Switched” is positive with respect to “Primary Non Switched” during discharge. The spark plug centre electrode discharge will be negative with respect to ground. Screened cable can be provided. The

screen is not connected to the coil and should be connected to the ECU.

*Coils designed to operate with a 10A supply are available

** Firing the coil off load should be avoided as it can cause cumulative damage by electrical breakdown

*** Coils can be provided with integral suppression resistors to reduce radiated EMC. However, this reduces the energy and burn time of the spark.

Application

- Transistorised ignition systems

Mechanical

- Polyester body
- Minimum diameter 20mm
- Minimum length from top of coil to top of spark plug 80mm

The body can be made longer and/or wider to suit a specific installation

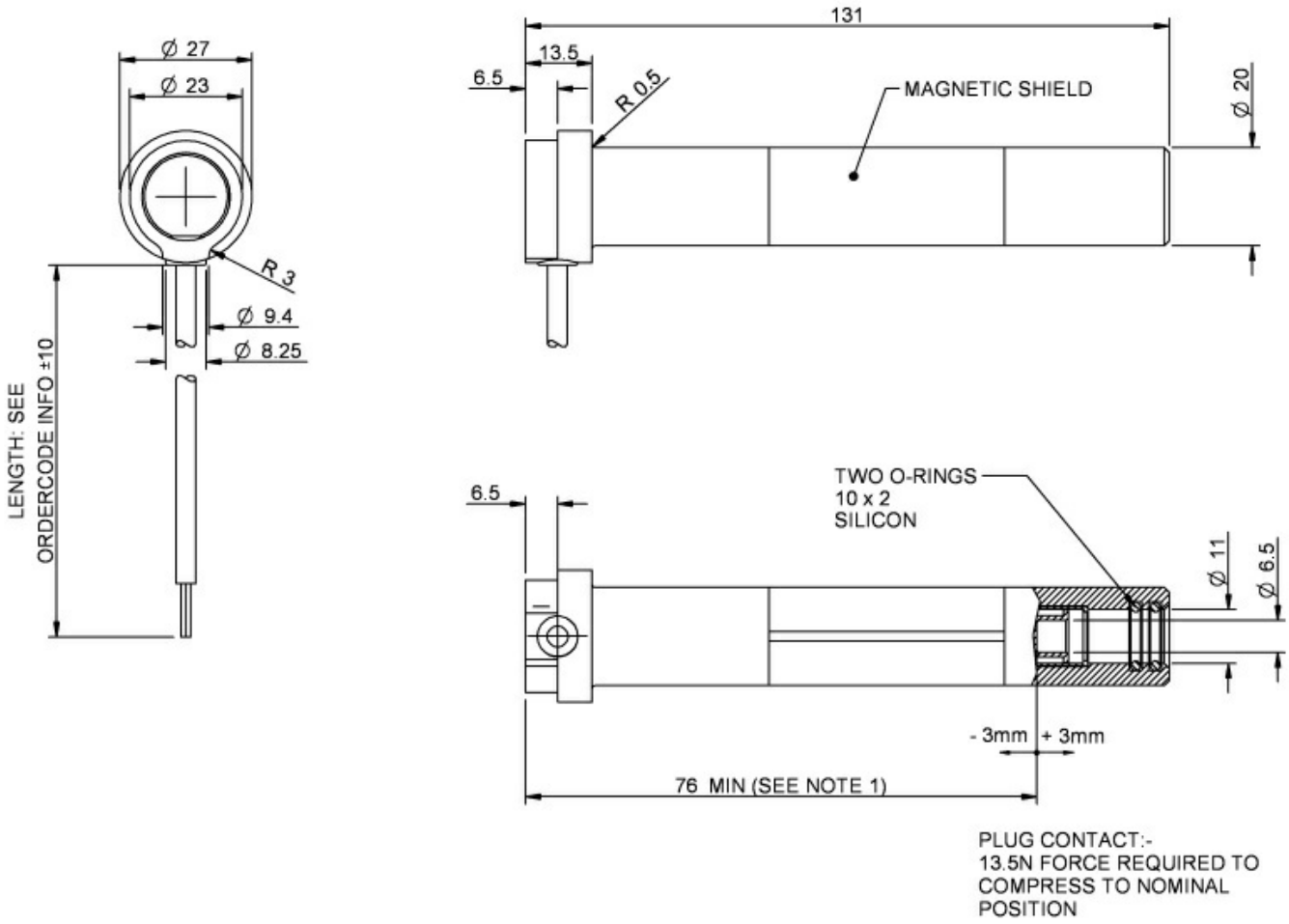
- HT connection plunger travel 3mm
- A fixed HT contact can be provided
- Plunger force at max travel 10±1N
- Axial clamping force 35 to 45N
- Weight less than 130g (including 1000mm cable)
- Elastomer boot for strain relief to the coil body
- Fluoro silicone boot or o-rings to seal spark plug

Environmental

- Resistant to standard motorsport fluids
- Operating temperature 0 to +150°C
- Maximum temperature +180°C for 10mins (coil not firing)
- DR25 jacketed cable
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Images/Diagrams

TSI Coil



NOTE 1 - DIMENSIONS TO SUIT CUSTOMERS REQUIRMENTS

Ordercodes

Description	Ordercode
Please contact our technical consultancy service to discuss your requirements.	O 030 XXX XXX XXX

Electronics

Control Units

Electronic Control Unit TAG-400N (NASCAR)

The TAG-400N is a compact, self-contained engine management system and data logger for race engines up to eight cylinders. The unit is complete with integrated ignition and injection drivers and so needs no external units to run an engine.

The TAG-400N exploits Freescale Power architecture technology to provide a powerful and flexible platform for extracting the optimum performance from an engine. Turnkey systems or customer prepared applications are both supported.

Large internal data logging memory and data analysis tool licence included.

Security protection features for mandated software applications and code verification/checking tools available as standard.

Race-proven single-series pedigree.

In Detail

Application

- Control and monitoring of engine and/or gearbox.

Electrical

- Supply Voltage 7.9 to 16.0V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- TAGOS 32-bit Real Time Operating System
- Data logging memory capacity 256Mbyte

Mechanical

- Case material hard anodized aluminum
- Weight 22 ounces

Other Features

- Status LEDs included for ease of use.
- One System Monitor configuration tool software licence supplied per team purchasing TAG-400Ns.

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber

- Maximum humidity 100%
- Minimum operating temperature 14°F
- Internal temperature not to exceed 160°F as measured by internal diagnostic sensors
- Storage temperature 14 to 185°F
- Vibration 100 to 1000Hz, all axes, 24hrs

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Connection Definition

- Integral, sealed, military-standard connectors.

Sensor Inputs

- Two Inductive Speed Sensors (Crank)
- Four HE Speed Sensors (Cam + spares)
- 22 Analog (0 to 5V)
- Four Pt1000 Temperature Sensors (configurable as analogs in software)
- Three NTC Temperature Sensors (configurable as analogs in software)
- Two Wideband Lambda
- Three switches to GND
- One lap trigger

Outputs

- Eight high-voltage (30V) switched mode, current controlled injector drive stages
- Eight inductive ignition drive stages
- Two low side drivers
- Two high side drivers (can be software configured as one 16kHz H-bridge driver)
- Five high side drive stages
- Two Lambda heaters (5A)
- Two Tacho/Speedo outputs
- Four 0-5V Gauge Drivers
- External sensor supplies

Communications

- One Ethernet
- Two CAN 2.0B bus (up to 1Mbps)
- One RS232 (up to 222kbps

Data logging

- 256Mbyte

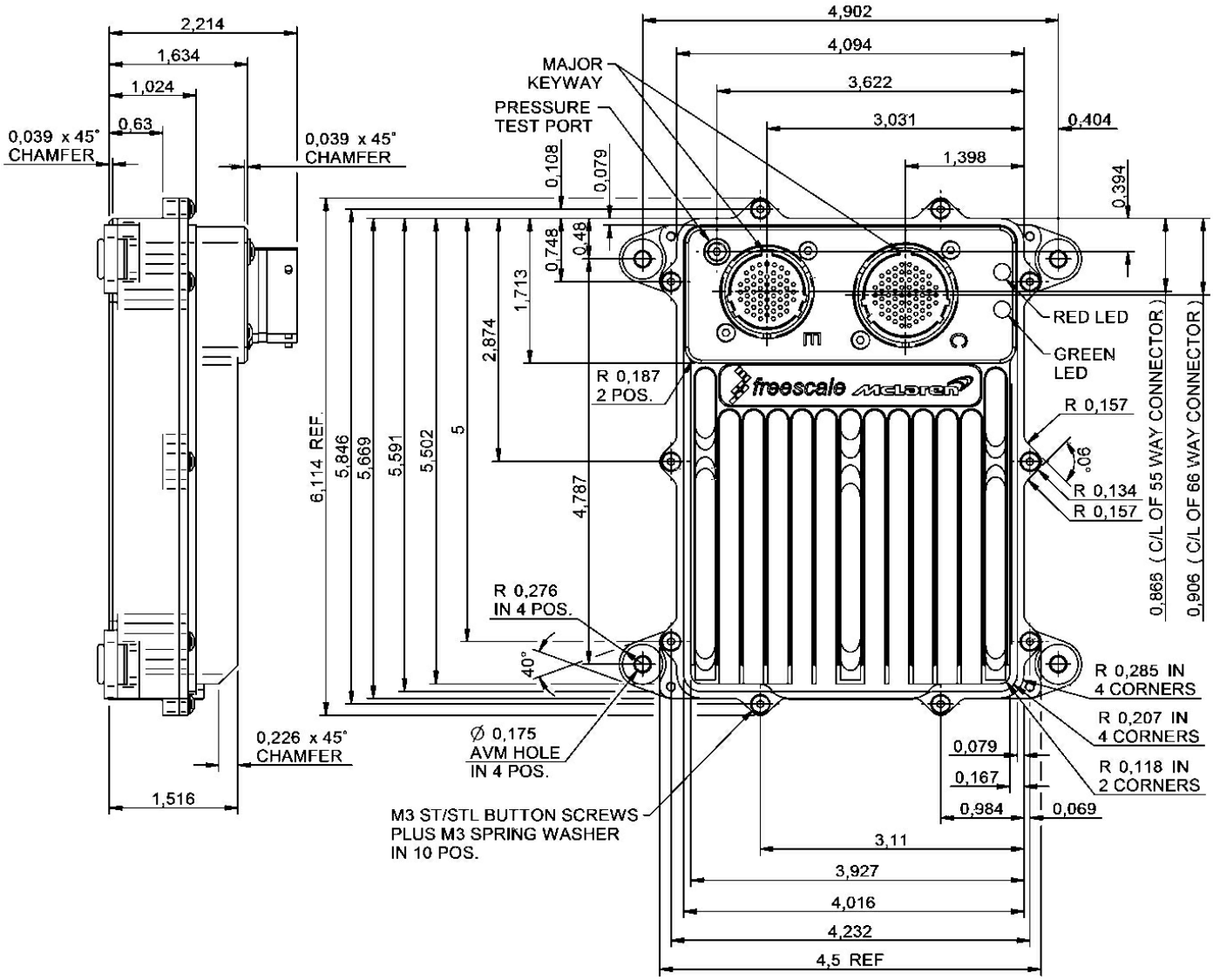
Diagnostics

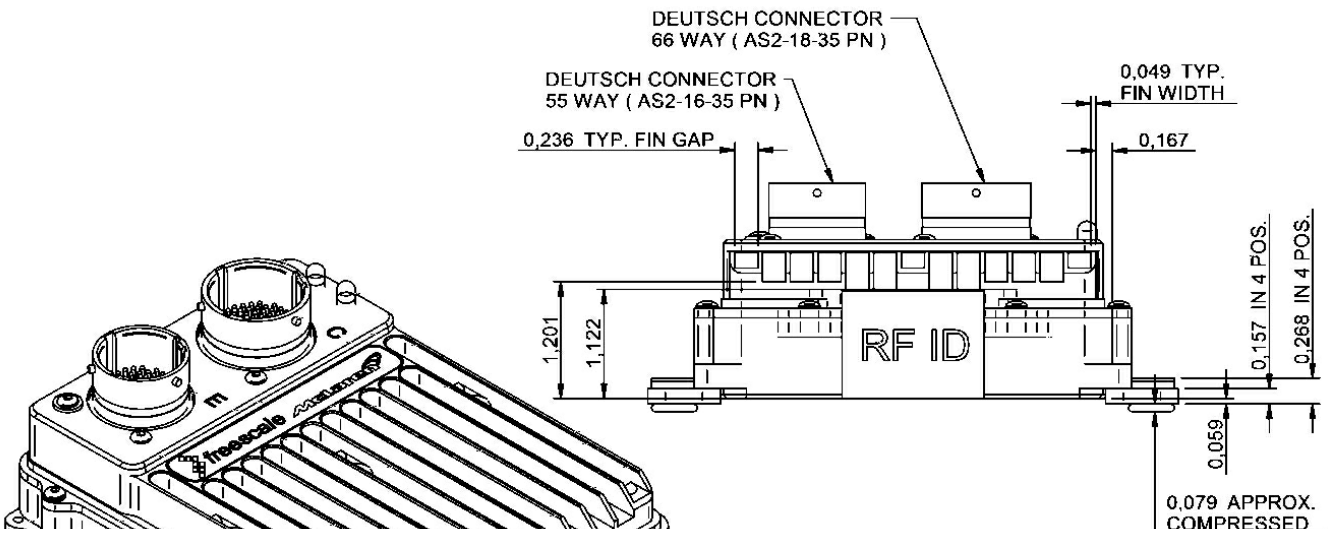
- Sensor readings are checked for out of range and open circuit

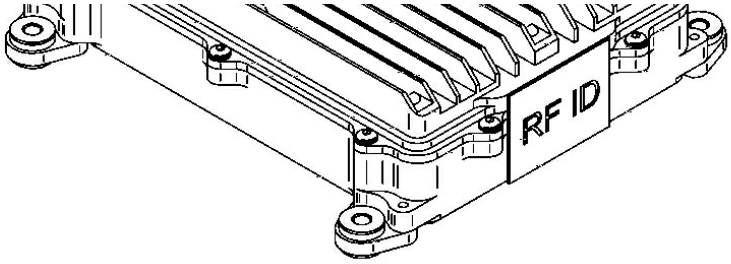
- Board temperatures
- Unit supply voltages

Images/Diagrams

S 030 012 011 009







AV MOUNT

Connector Diagram

Connector Details

Engine Connector

←	2 Inductive speed
	4 Hall Effect speed
	2 Lambda
	2 Lambda heater
	8 Ignition drivers
	8 Injection drivers
→	2 Low Side Drivers
	3 High Sides Drivers
	2 Tacho/Speedo
	2 Gauge Driver
↔	1 CAN

Chassis Connector

←	22 Analogue inputs
	3 Switch inputs
	7 Temperature
	1 Lap trigger
→	2 Gauge Drivers
	2 High Sides
	2 High Sides/1 H-Bridge
↔	1 Ethernet
	1 CAN
	1 RS232

Ordercodes

Description	Ordercode
TAG-400N	S 030 012 011 009

Electronic Control Unit TAG-400

The TAG-400 is a compact, self-contained engine management system and data logger for race engines up to eight cylinders. The unit is complete with integrated ignition and injection drivers and so needs no external units to run an engine.

The unit is suitable for controlling high-revving motorcycle engines plus normally-aspirated and turbo-charged rally, sportscar or open-wheel racing cars. Advanced traction control, Knock control and quickshift features can all be provided, where permitted by regulations.

The TAG-400 exploits Power PC technology to provide a powerful and flexible platform for extracting the optimum performance from an engine. Turnkey systems or customer prepared applications are both supported.

Application code may be autocoded using our Graphical Development Environment (GDE) from Matlab/Simulink control modules.

In Detail

Application

- Control and monitoring of engine and/or gearbox.

Electrical

- Supply Voltage 7.9 to 16.0V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- TAGOS 32-bit Real Time Operating System
- Data logging memory capacity 16Mbytes (1Gbyte version also available)

Mechanical

- Case material hard anodised aluminium
- Weight 585g

Other Features

- One System Monitor configuration tool software licence supplied per team purchasing TAG-400s

Connection Definition

- Integral, sealed, military standard connectors

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Maximum humidity 100%
- Minimum operating temperature -10°C
- Internal temperature not to exceed 70°C as measured by internal diagnostic sensors
- Storage temperature -10 to +85°C
- Vibration 100 to 1000Hz, all axes, 24hrs

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Sensor Inputs

- Two Inductive Speed Sensors
- Four DHE Speed Sensors
- 18 Analog (0 to 5V)
- Four Pt1000 (or NTC) Temperature Sensors (configurable as analogs)
- Three NTC Temperature Sensors (configurable as analogs)
- Two K type thermocouples
- Two Wideband Lambda
- Four Knock Sensors (configurable as analogs)
- Three switch (configurable as analogs)
- One lap trigger

Outputs

- Eight High Voltage (30V) switched mode, current controlled injector drive stages
- Eight inductive ignition drive stages
- Six Low side drivers (pairs of low-sides can be software configured as 500Hz H-bridge drivers or as 20mA Moog drive stages)
- Two High side drivers (can be software configured as one 16kHz H-bridge driver)
- Five High side drive stages
- Two Lambda heaters
- Two Tacho/Speedo outputs
- Two Oscilloscope Diagnostic
- External sensor supplies

Communications

- One Ethernet
- Two CAN 2.0B bus (up to 1Mbps)
- One RS232 (up to 222kbps)

Data logging

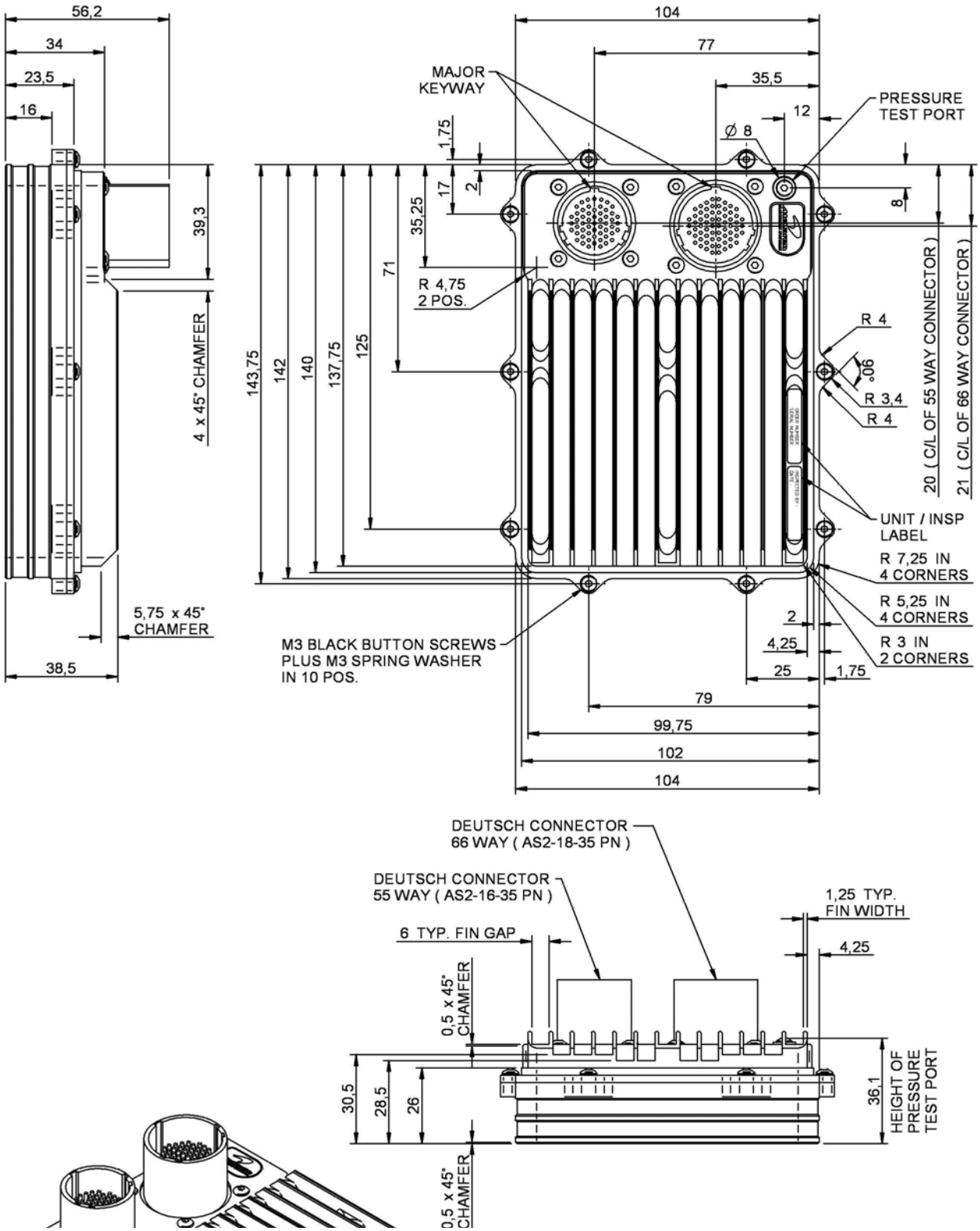
- 16Mbytes (standard) or 1Gbyte logging memory (factory fit option)

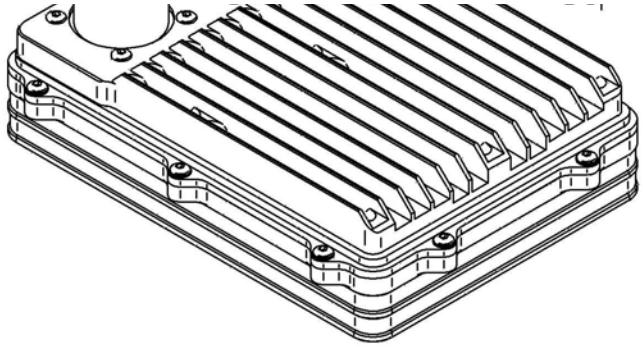
Diagnostics

- Sensor readings are checked for out of range and open circuit
  - Board temperatures
  - Unit supply voltages

Images/Diagrams

O 030 012 011 XXX





Ordercodes

Description	Ordercode
TAG-400 (16Mbyte logging memory)	O 030 012 011 000
TAG400 (1Gbyte logging memory)	O 030 012 011 006

Engine Control Unit TAG-400i

The TAG-400i is a compact, self-contained engine management system and data logger for race engines.

The unit is an evolution of the TAG-400 which has been used successfully in open-wheel and motorcycle racing applications. The TAG-400i has extended functionality with increased processing power and I/O capability.

The TAG-400i exploits Power PC technology, but with an uprated processor that now offers more than six times the application processing power than the TAG-400, providing a powerful and flexible platform for extracting the optimum performance from an engine.

The TAG-400i can be offered as part of a turnkey system or can support customer prepared applications autocoded from Simulink models using our Graphical Development Environment (GDE).

In Detail

Application

- Control and monitoring of engine and/or gearbox.

Electrical

- Supply Voltage 7.9 to 16.0V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- TAGOS 32-bit Real Time Operating System
- Data logging memory capacity 1Gbyte
- High performance application processor running at 264MHz

Mechanical

- Case material hard anodised aluminium
- Weight 939g

Other Features

- One System Monitor configuration tool software licence supplied per team purchasing TAG-400i

Connection Definition

- Integral, sealed, military standard connectors

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Maximum humidity 95% non-condensing
- Minimum operating temperature -10°C
- Internal temperature not to exceed 70°C as measured by internal diagnostic sensors
- Storage temperature -10 to +85°C
- Vibration 100 to 1000Hz, all axes, 24hrs

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Sensor Inputs

- Four Inductive Speed Sensors (two Crank Sync; two Turbo speed)
- One DHE Cam Sensor
- Four DHE Speed Sensors
- 23 Analog (0 to 5V, 1KHz)
- Seven NTC Temperature Sensors (configurable as analogues)
- Two K-type thermocouples
- Two wideband Lambda
- Four Knock Sensors (configurable as analogues)
- 10 switches
- One Lap trigger

Outputs

- Eight inductive ignition drive stages (20A)
- Eight manifold injector drive stages (30V)
- Eight trigger outputs for external injector drive unit
- One Timesync for external drive unit
- One High side driver (5A)
- Two High side drivers (3A)
- Eight High side drivers (2A)
- Six Low side drivers (1A)
- Two Low side drivers (Tacho/Speedo) (0.5A)
- Two H-Bridge Drivers (7.5A)
- Two Engine Synchronous low side drivers (1.5A)
- Two Lambda heaters
- Two Oscilloscope Diagnostic
- External sensor supplies

Communications

- One Ethernet

- Four CAN 2.0B bus (up to 1Mbps)
- One RS232 (up to 222kbps)

Data logging

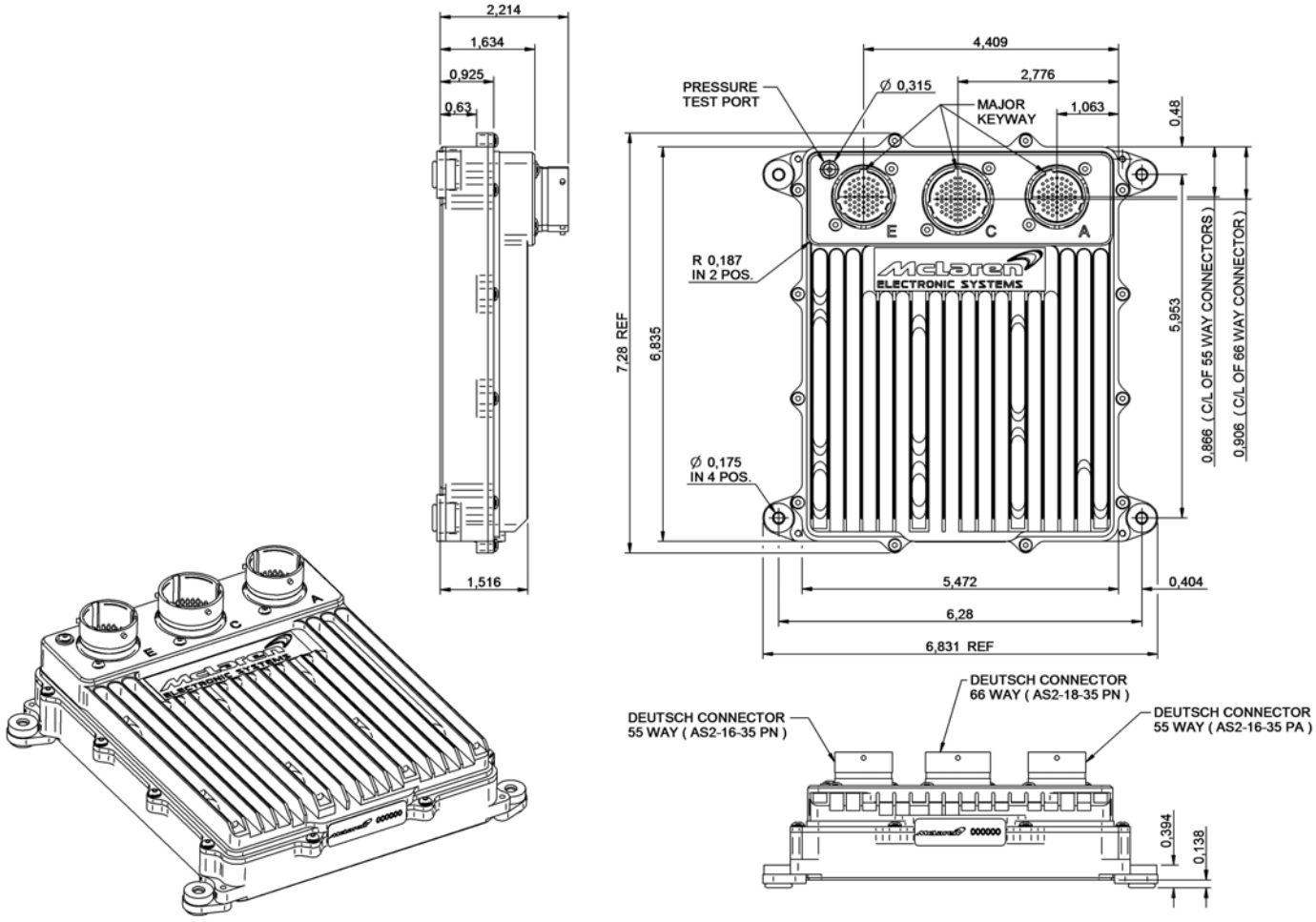
- 1Gbyte

Diagnostics

- Sensor readings are checked for out of range and open circuit
    - Board temperatures
    - Unit supply voltages

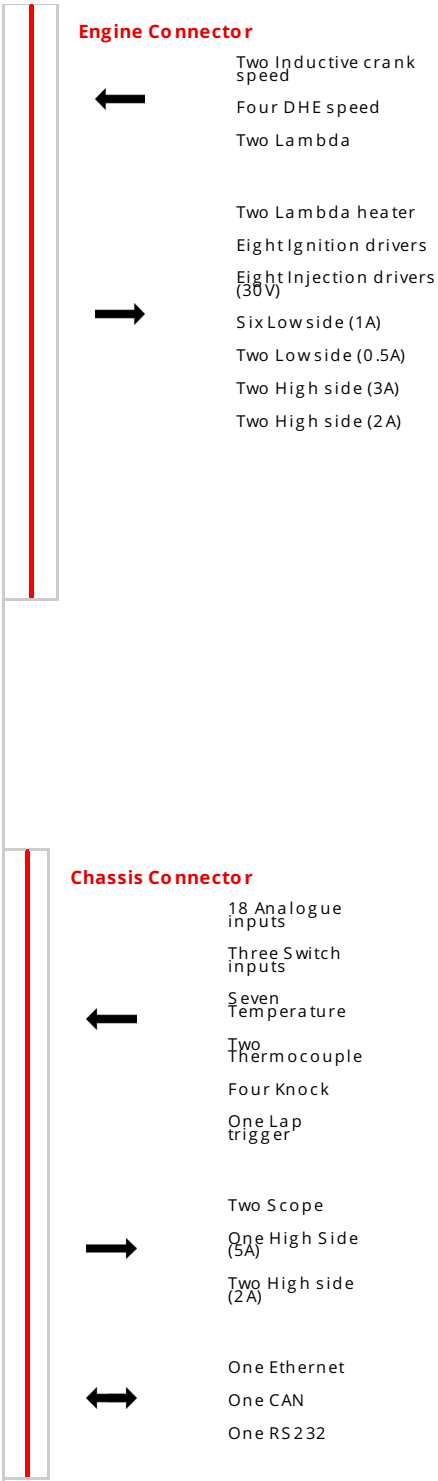
Images/Diagrams

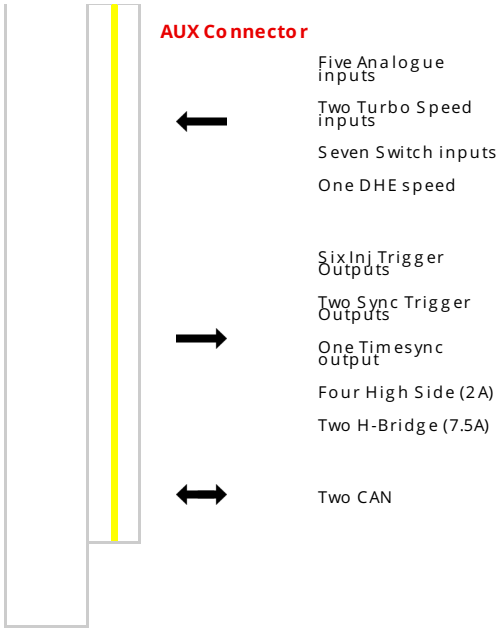
O 030 012 015 XXX



Connector Diagram

Connector Details


Engine Connector
Two Inductive crank speed
Four DHE speed
Two Lambda
Two Lambda heater
Eight Ignition drivers
Eight Injection drivers (30V)
Six Low side (1A)
Two Low side (0.5A)
Two High side (3A)
Two High side (2A)
Chassis Connector
18 Analogue inputs
Three Switch inputs
Seven Temperature
Two Thermocouple
Four Knock
One Lap trigger
Two Scope
One High Side (5A)
Two High side (2A)
One Ethernet
One CAN
One RS232



Ordercodes

Description	Ordercode
TAG-400i	O 030 012 015 000

Powertrain & Chassis Control Unit CIU-100

CIU-100 is a cost-effective auxiliary processing unit for general purpose control applications. The CIU-100 provides a powerful 128MHz processing platform with 1kHz sampling of analogue input channels and actuation of high/low side drive stage pairs. A PowerPC processor provides the processing resource for application code which may be autocoded from Matlab/Simulink using our GDE and reprogrammed using the System Monitor application tool.

The unit includes three CAN interfaces for communication with System Monitor, the host ECU and other CAN linked system devices.

The CIU-100 can be used as a stand-alone control unit with a direct CAN connection to System Monitor for programming and configuration or could make an ideal companion to one of our ECUs.

In Detail

Application

- General control applications
- Solenoid/hydraulic system control
- Interfacing to remote sensors
- CAN linked I/O expansion

Electrical

- Supply Voltage 8 to 16V DC
- BIOS 32-bit Real Time Operating System
- 128MHz 32-bit application processor
- System memory: 2Mbyte Flash, 64kbyte SRAM
- 40MHz monitor processor for SIL functionality

Sensor Inputs

- 21 general purpose 0 to 5V analogue inputs
- Six NTC (configurable as analogue, 0 to 5V)
- Eight speed sensor inputs (Schmidt)
- Two general purpose digital inputs (12V)
- One "ignition switch" input, with keep-alive

Outputs

False

Communications

- Three CAN bus interfaces up to 1Mbps (two with wake-up)

Diagnostics

- Dual on-board temperature sensors
- Dual hardware and software watchdogs
- Onboard power supply sensing and I/O diagnostics

Mechanical

- Cast aluminium housing, black painted pressed steel lid
- Weight 850g

Connection Definition

- One 154-way connector divided into two cavities (96, 58-way)

For pin numbers, please request further details from our Technical Consultancy Department.

Environmental

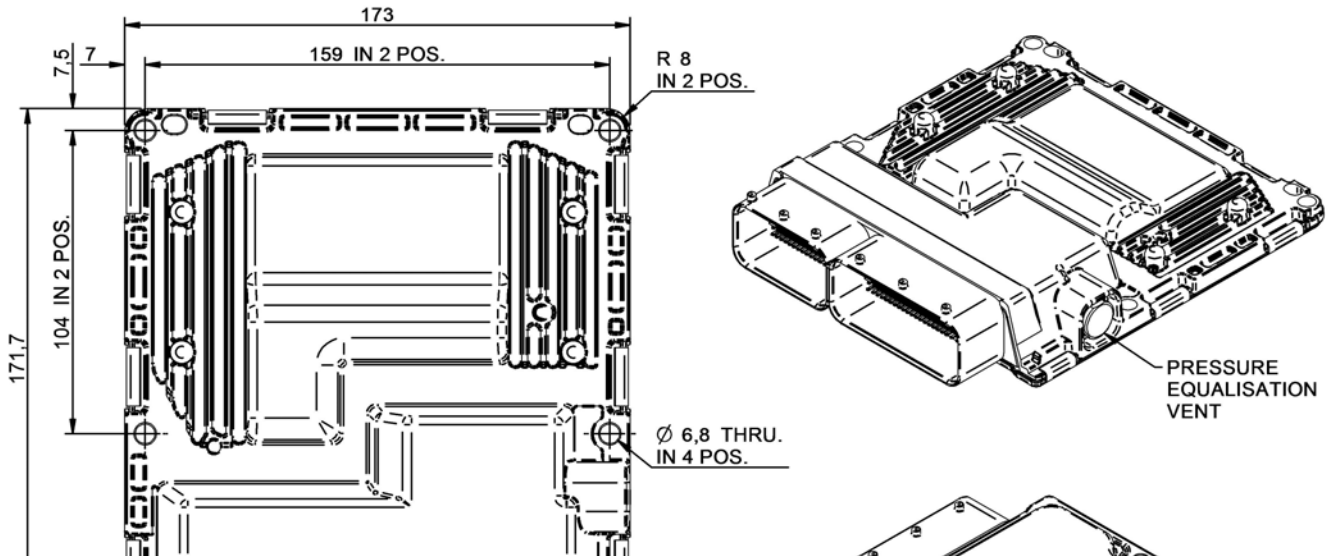
- Permanently sealed (water resistant to IP6K)
- Maximum humidity 100%
- Operating temperature -40°C to +85°C (as seen internally)
- Storage Temperature -10°C to +85°C
- Vibration 100 to 1000Hz, all axes, 24 hours
- Vibration isolation is recommended

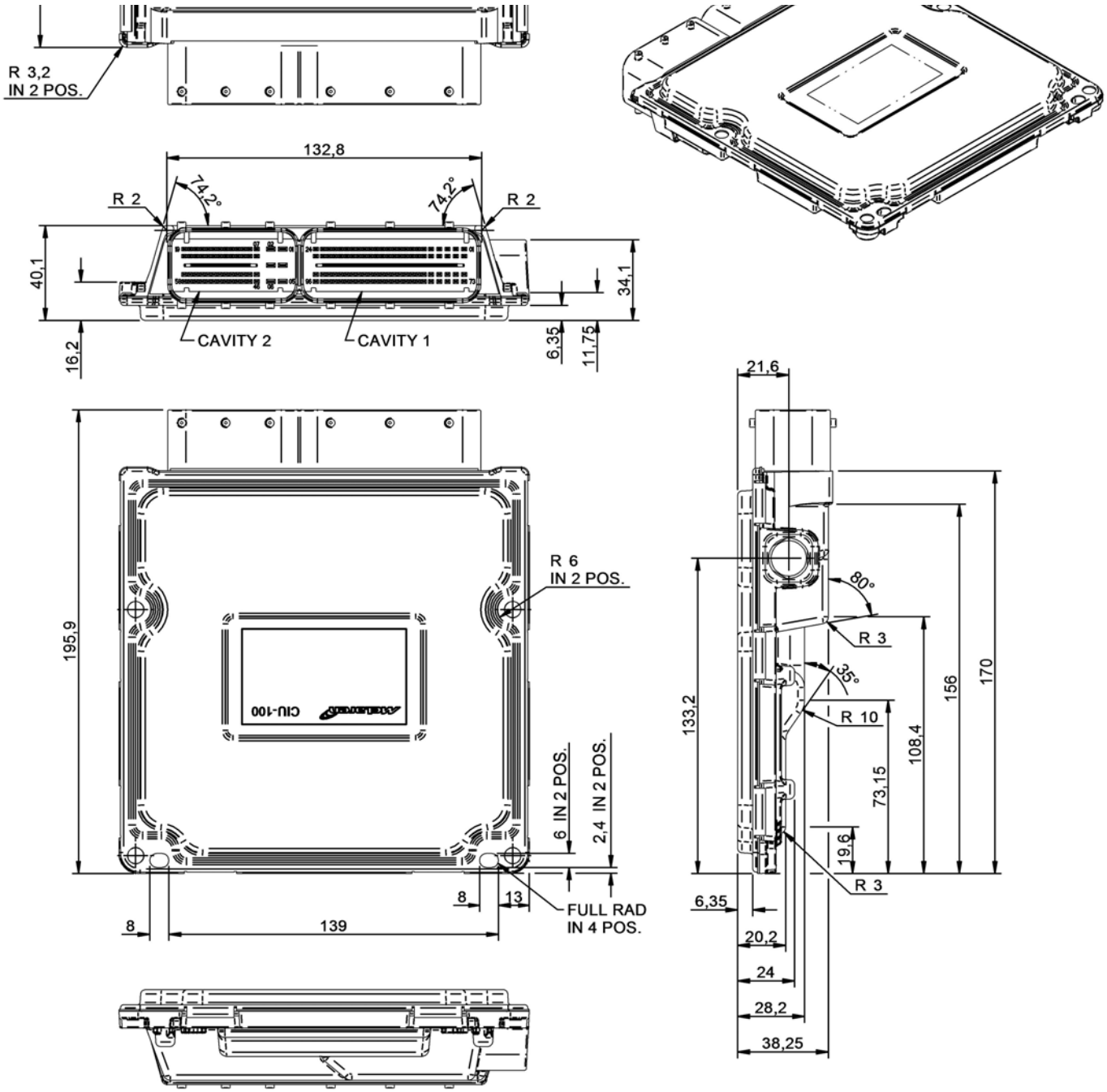
Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Images/Diagrams

O 030 110 015 000





Ordercodes

Description	Ordercode
CIU-100	O 030 110 015 000

Powertrain Control Unit TAG-320

TAG-320 is the main processing unit for powertrain control of a racing car. It may be used with an external driver unit to provide direct control of ignition and direct or manifold injection, along with all other powertrain control functions. The TAG-320 provides a powerful processing platform with minimum latencies for customer applications based on 32-bit microprocessors. Application code is autocoded from Matlab/Simulink control modules. Advanced data logging, high-speed telemetry control and rich communications are all provided.

The TAG-320 is built with full FIA security measures including advanced memory protection and supports applications already running on the TAG-310B.

In Detail

Application

- Control and monitoring of a racing car powertrain
- Up to 8-cylinder engines
- Throttle-by-wire
- Clutch-by-wire
- Semi-automatic gearbox
- Powerful onboard data logging and telemetry control
- Ethernet connection to application and data analysis tools (System Monitor and ATLAS)

Key Features

- Application processing power 4000MIPS
- Extremely low latency, high frequency input sampling
- Digital filtering on all analogue inputs
- Data logging memory 8GB Flash

Electrical

- Supply voltage 7.5 to 16V DC
- Supply voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Supply current quiescent (ignition off) 4mA
- Supply current operating (no load on outputs) 3A typical at 13.8V
- Supply current operating (max load on supplies) 5A typical at 13.8V

- 32-bit Real Time Operating System
- Internal tri-axis accelerometer

Mechanical

- Aluminium case (hard black anodised)
- Weight 1.35kg

Connection definition

Integral, sealed, motorsport connectors:

- Connector A 66-way
- Connector B 114-way
- Connector C 114-way

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Internal temperature not to exceed 70°C as measured by internal diagnostic sensors
- Adequate forced-air cooling must be applied to ensure the internal operating temperature remains within specified limits
- Storage temperature -25°C to +85°C
- Vibration 100 to 1000Hz, all axes, 24 hours
- Vibration isolation is recommended

Electro Magnetic Compatibility

Complies with the essential protection requirements of 89/336/EEC

Service

Recommended service interval 12 months (internal battery is replaced)

Sensor Inputs

- Up to 66 general-purpose 0 to 5V analogue inputs (12-bit, 10ksps, four of which are software configurable as general-purpose TTL outputs)
- 16 general-purpose configurable 0 to 5V or Pt1000 analogue inputs (12-bit, 10ksps)
- Eight general-purpose configurable 0 to 5V analogue inputs with optional strong pull-ups for use with digital switches (12-bit, 10ksps)
- Four high-speed 0 to 5V analogue inputs (12-bit, 100ksps)
- “Pits pedal” and “Ethernet IP address” analogue inputs (12-bit, 1ksps)
- Three inductive or DHE speed inputs (factory configured)
- Eight DHE speed inputs
- Two K-type thermocouple inputs (12-bit)

- Two wide-band lambda interfaces (12-bit)
- Lap trigger interface
- Ignition switch input

Outputs

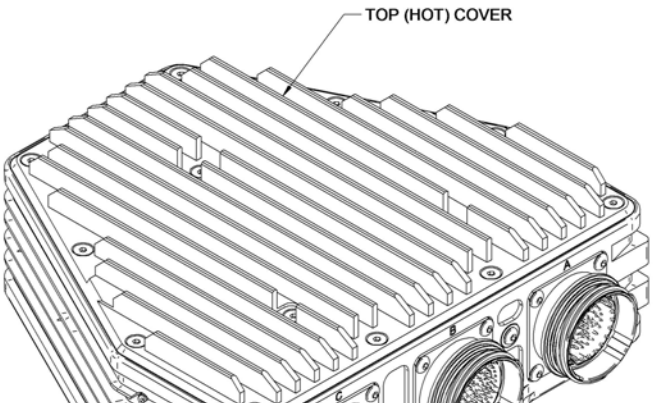
- 10 ±12mA servo valve drive stages (10ksps)
- 10 3A low-side drive stages (software configurable for freewheel or fast-turn-off operation)
- 10 1A high-side drive stages
- One 3A high-side drive stage
- Eight 7A high-side drive stages
- Eight TTL injection control outputs
- Up to four general-purpose TTL outputs (all of which are software configurable as analogue inputs)
- Eight open-drain ignition control outputs
- Eight general purpose open-drain outputs
- Two RS422 differential outputs for 1ms time synchronisation and engine synchronisation signals
- Two oscilloscope outputs
- Four 150mA 12V sensor supplies
- One 150mA 10V sensor supply for digital-output sensors
- One 150mA 5V supply for lap trigger receiver
- Eight 100mA 5V precision sensor supplies

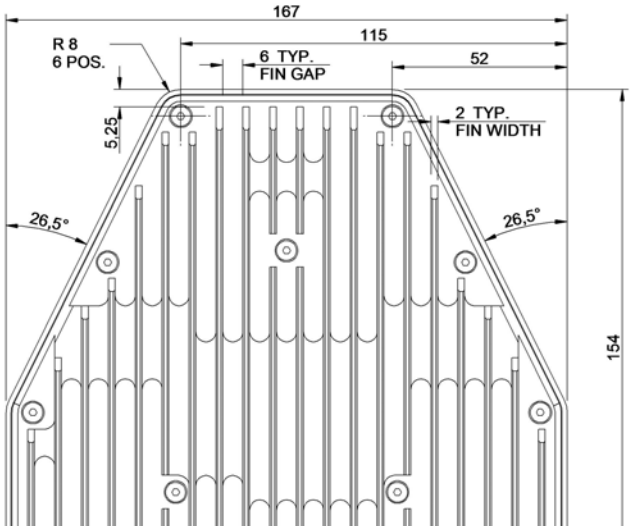
Communications

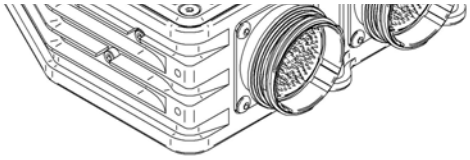
- One Wired Gigabit Ethernet interface
- One RS232 interface (1Mbps maximum)
- One ARCNET interface (10Mbps maximum)
- One dual-channel FlexRay interface (20Mbps)
- 11 CAN interfaces (1Mbps maximum)

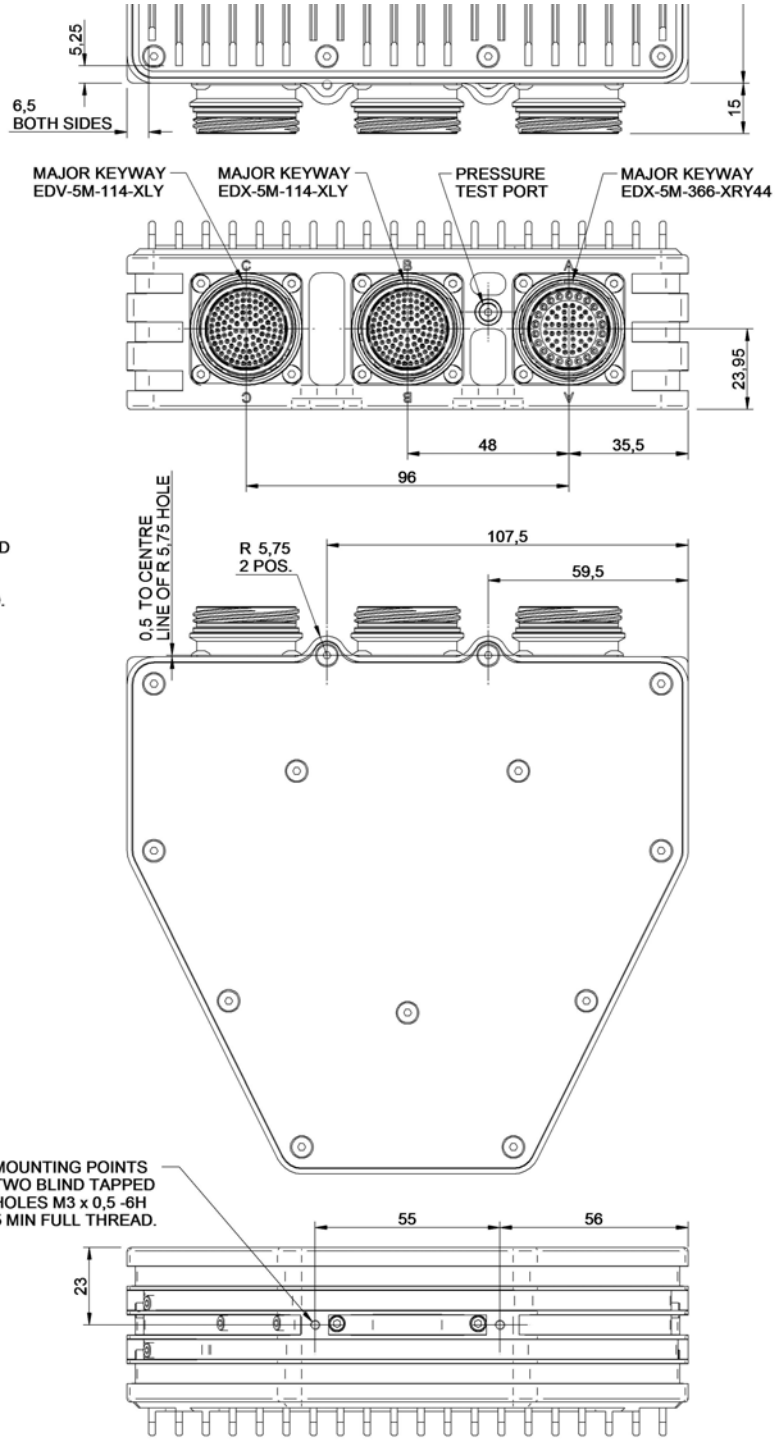
Images/Diagrams

O 030 072 017 000



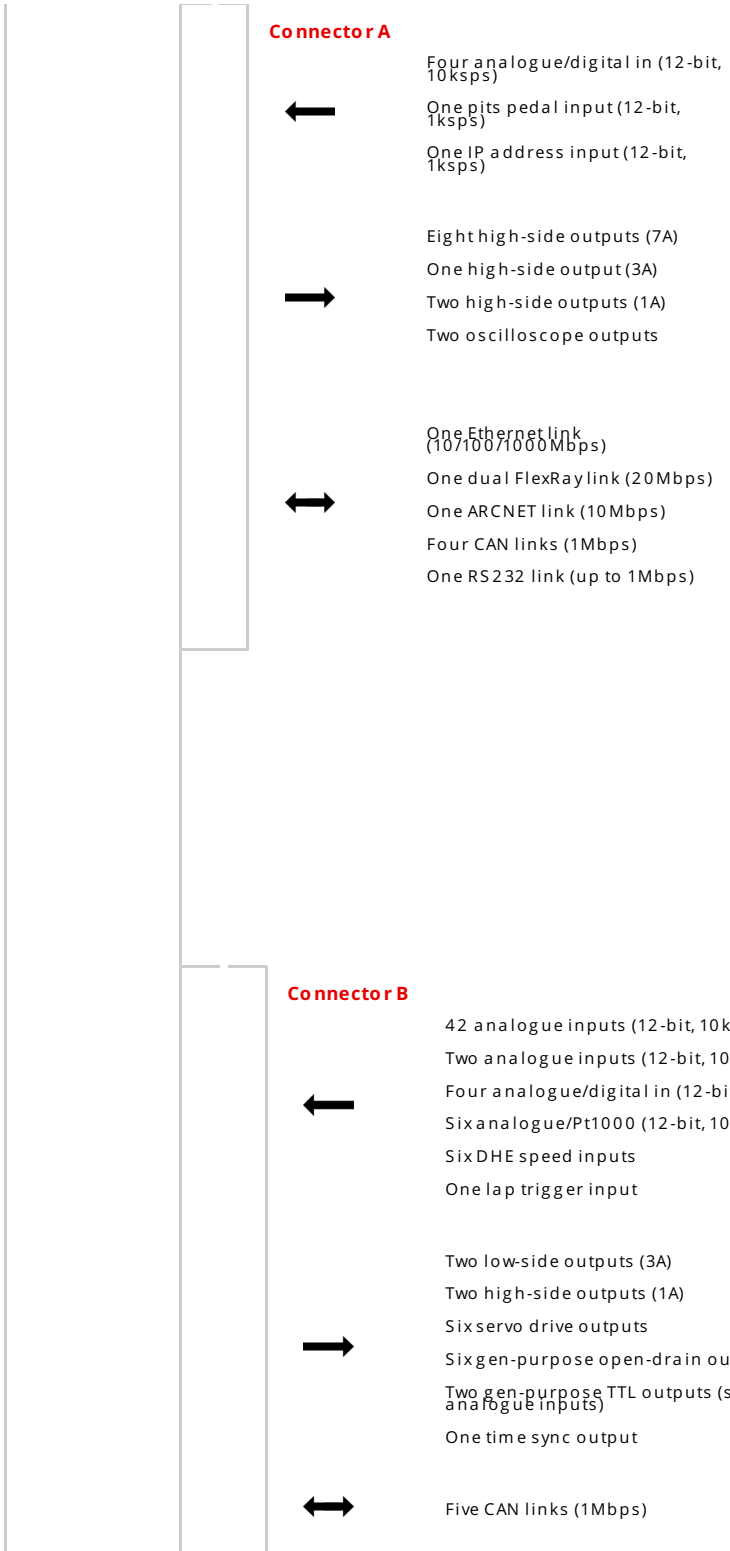






Connector Diagram

Connector Details


Connector A
Four analogue/digital in (12-bit, 10ksps)
One pits pedal input (12-bit, 1ksps)
One IP address input (12-bit, 1ksps)
Eight high-side outputs (7A)
One high-side output (3A)
Two high-side outputs (1A)
Two oscilloscope outputs
One Ethernet link (10/100/1000Mbps)
One dual FlexRay link (20Mbps)
One ARCNET link (10Mbps)
Four CAN links (1Mbps)
One RS232 link (up to 1Mbps)
Connector B
42 analogue inputs (12-bit, 10ksps)
Two analogue inputs (12-bit, 100ksps)
Four analogue/digital in (12-bit, 10ksps)
Six analogue/Pt1000 (12-bit, 10ksps)
Six DHE speed inputs
One lap trigger input
Two low-side outputs (3A)
Two high-side outputs (1A)
Six servo drive outputs
Six gen-purpose open-drain outputs
Two gen-purpose TTL outputs (shared with analogue inputs)
One time sync output
Five CAN links (1Mbps)

Connector C

24 analogue (12-bit, 10ksps), one of which may be used as a second lap trigger input
Two analogue (12-bit, 100ksps)
10 analogue/Pt1000 (12-bit, 10ksps)
Two DHE speed inputs
Two thermocouple input
Three inductive speed sensor inputs
Two wide-band lambda inputs

Eight low-side output (3A)
Six high-side output (1A)
Eight open-drain ignition control outputs (four shared with DHE speed inputs)
Eight TTL injection control outputs
Four servo drive outputs
Two general-purpose open-drain outputs
Two general-purpose TTL outputs (shared with analogue inputs)
One engine sync output

Two CAN links (1Mbps)

Ordercodes

Description	Ordercode
TAG-320 (eight ignition control outputs and eight DHE speed inputs)	O 030 072 017 000

Displays

Display Module PCU-8D

The PCU-8D is a lightweight driver display module designed for general motorsport applications. It is designed to connect to a host ECU via CAN and present the driver with information on a 4.3" display and LED lamps. The display is suitable for use in direct sunlight and at night. The text and graphics layout of the screen is user-configurable via PC software. 100 pages are available, and are selectable by CAN message.

In Detail

Application

- Data display and warning lamps
- Typically installed within the steering wheel, although can also be remotely mounted

Display

- 4.3" backlit LCD display
- Viewable area 95mm x 54mm, 480 x 272 pixel resolution
- Viewable in direct sunlight. Brightness adjustable via CAN message for low-light conditions
- 16 Gauge types for displaying data, including bar tacho, rev lights and variable text
- 100 user-configurable page, selectable by CAN message
- The display is fully customisable; page layout can be configured by PC with text and gauges
- Alarm pages or user-configurable text warnings can be triggered by CAN messages

Communications

- One CAN interface (1Mbps). No internal termination
- One USB interface for configuration only

Unit Inputs

- One reset input (active low with internal pull-up; can be left unconnected if not required)
- One CAN address selection analogue input (connect an external resistor to unit supply ground)

Other Features

- Configuration software tool supplied with the unit

Electrical

- Supply voltage 8V to 16V DC

- Supply current:

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 2004/108/EEC

Environmental

- Size: 130mm x 81mm x 22mm
- Weight: <230g
- Splash resistant to standard motorsport fluids
- Lid has a rubber seal, case fixings are sealed with silicone sealant
- Maximum humidity: 95% non-condensing
- Operating temperature: 0°C to +50°C
- Storage temperature: -25°C to +85°C
- Vibration: 100Hz to 1000Hz, all axes, 24 hours
- Vibration isolation is recommended

Connection Definition

- Un-terminated flying lead only (no connector fitted), length 1000mm
- 28 AWG wire for all wires unless stated
- USB wires are contained within a cable screen, with the other wires coiled round the USB screened cables
- Note the unit supply is required when configuring. The unit cannot be powered by USB
- Wire colours:
-

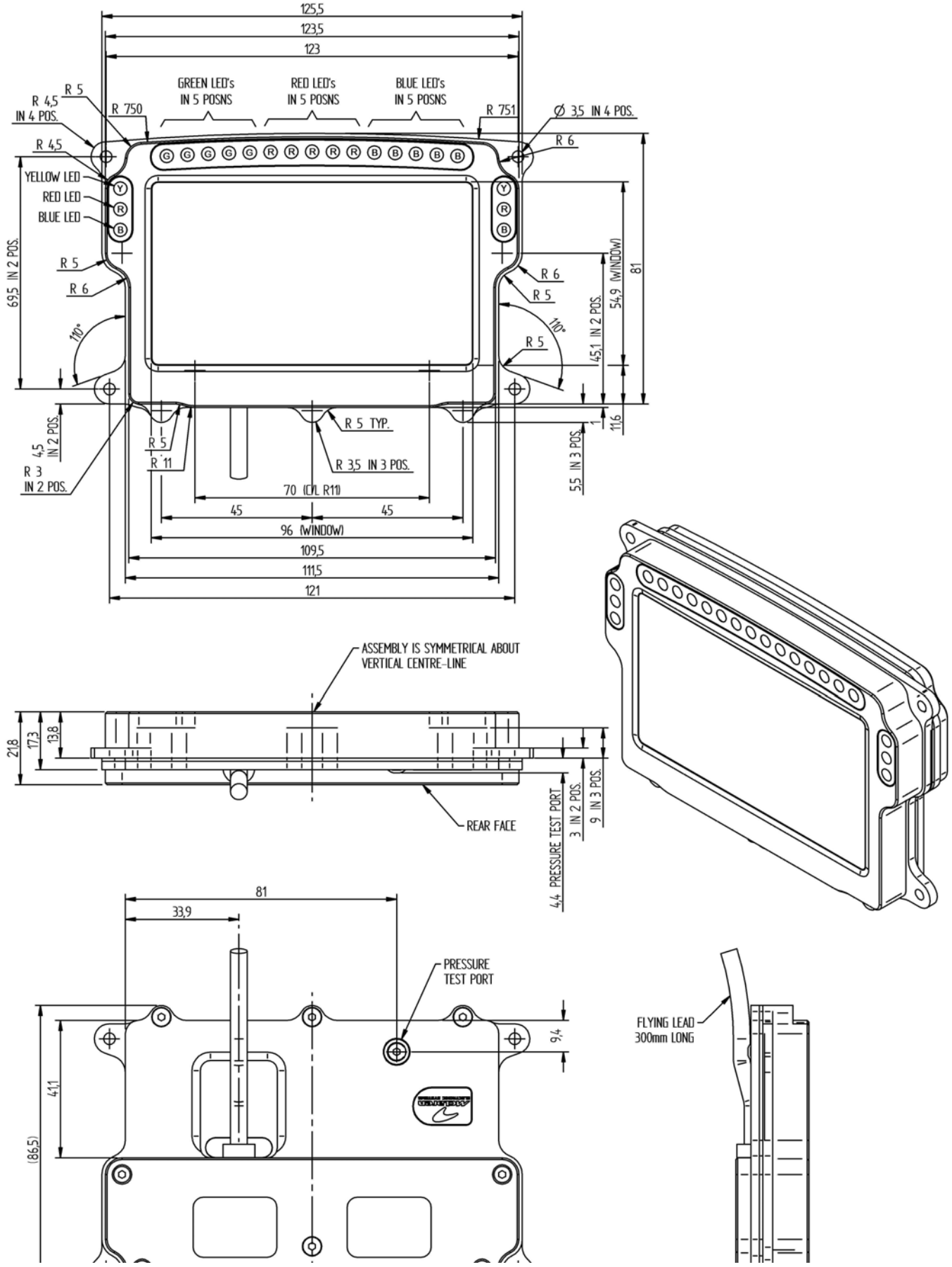
Orange	Unit Supply Positive
Brown	Unit Supply Ground
White	CAN +
Blue	CAN -
Green	USB+
White	USB -
Red (28 AWG)	USB 5V
Black (28 AWG)	USB Ground
-	USB Screen (internally connected to supply ground)
Grey	CAN address selection input
Yellow	Reset input

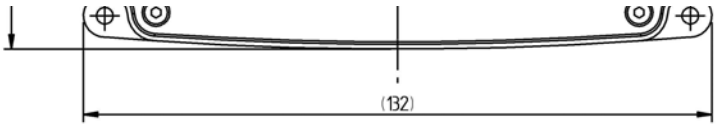
Example Screen Layouts

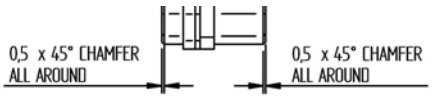
- The configuration software allows each page layout to be fully customised

Images/Diagrams

O 030 020 011 002







Ordercodes

Description	Ordercode
Panel Display Unit PCU-8D	O 030 020 011 002

Display Module PCU-500N

The PCU-500N is a large format driver display module featuring advanced graphics capabilities. The display unit is designed for motorsport applications and can be connected to any McLaren Applied Technologies (or a suitable third party) control unit via CAN.

The module integrates a tire pressure receiver with automated corner detection for use with McLaren Applied Technologies tire pressure sensors.

Supplied with module is McLaren Applied Technologies SoftDash application to create and customised display pages exactly to a drivers' requirements.

The digital dashboard module is suitable for use at night and in bright sunlight and has the capability to automatically adjust display brightness according to ambient light level.

In Detail

Application

Data Display

Display

- 12.3" color 1280 x 480 TFT display visible area 11.5" x 4.3"
- The TFT display is visible in both indoor applications (with a backlight) and outdoor applications (in a bright, sunlit environment)
- The TFT panel can display a variety of information to the user with text and graphics

Communications

- 1 Ethernet 10/100 Mbps
- 2 CAN, up to 1Mbps
- 3 RS232 interfaces, up to 500kbps

Inputs

- 9 Analog Inputs (0 to 5V)
- 1 Analog Input (0 to 5V) or Lap Trigger Input
- 2 Digital Speed Inputs (DHE)
- 2 Switch Inputs
- 4 Tire Pressure Receiver Inputs

- 1 Digital Video Interface (APIX2)

Outputs

1 5V 100mA Sensor Supply

Electrical

- Supply Voltage 8.5 to 16.0V DC
- Current draw 0.7A to 1.3A

Other Features

- 1GB Flash Logging Memory for data logging
- 3-axis Accelerometer ±16g
- Real Time Clock with Battery Backup
- System Monitor license included

Environmental

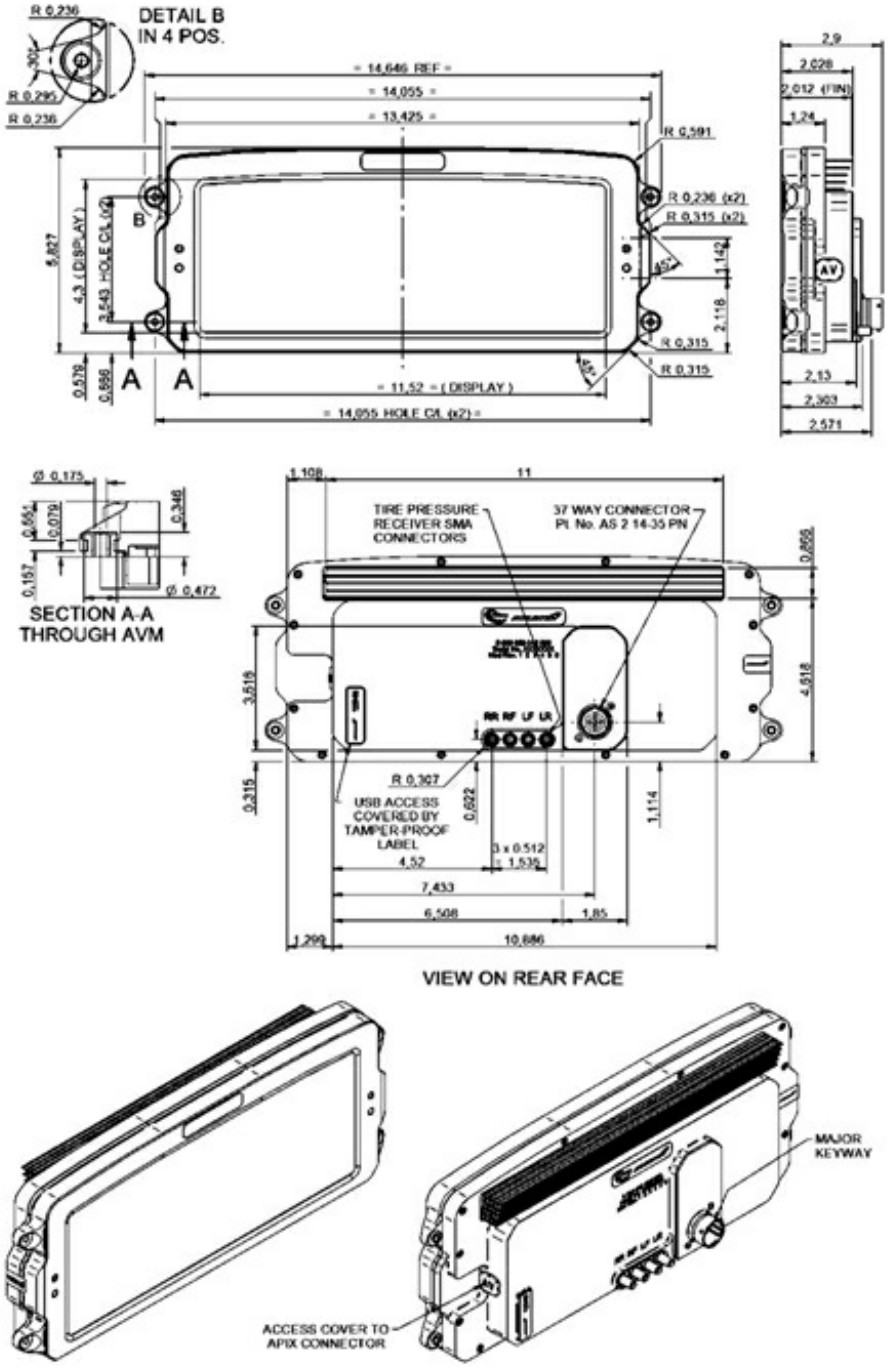
- IP20 Rated
- Operating temperature 14°F to +158°F
- Dimensions 14.6” x 5.8” x 2.9”
- Weight < 5lbs

Connection Definition

- Deutsch AS2-14-35PN for power, communications and I/O
- Female SMA for TPMS antennas

Images/Diagrams

S 030 020 012 000



Ordercodes

Description	Ordercode
PCU-500N	S 030 020 012 000

Hardware in the Loop

Factory HIL Hardware in the Loop

The Factory HIL provides a way of simulating the complete functionality of an F1 race car. I/O and simulation models are provided to drive the F1 Standard ECU components to simulate a typical run of the car ie. engine start, pull away and flying lap simulation, including gear shifting.

The HIL can also be used for car model and ECU set-up development. The HIL provides the connectivity for the majority of the I/O of all the current FIA Standard ECU components – TAG-320, 4xHIU-3, Powerbox 2006, CBT-610 and PCU-6D – when combined with the appropriate wiring harnesses, plus optional upgrades for the HSL-500 High Speed Logger.

The HIL is enclosed in a 9U rack including the PSU for the HIL and the car electronics. The units are connected via harnesses, which can be plugged into the back of the rack. The PCU-6D can be mounted on the front of the rack, which also provides connections for all CAN and other communication buses as well as scope outputs for the TAG-320 and Powerbox 2006.

The HIL plant model runs under vTAG-RT, allowing models to be developed in Dymola or Simulink with GDE 8.2 and for ATLAS & System Monitor to be used as front ends.

In Detail

Application

Full system simulation and car systems testing. The HIL is provided with a simple model that is able to drive the car around a basic circuit profile. The auto driver controls throttle, brakes and gears so that the embedded code in the TAG-320 runs as if it was on a real car.

The model is supplied as a Simulink source code so that it can be extended or replaced with teams own models.

The HIL runs vTAG-RT which provides an identical development environment to the ECU, i.e. it provides a logger which can be set up via System Monitor and monitored with ATLAS.

Processor

- Intel Core i7 2.8GHz processor
- 2GB DDR3 RAM
- 256Mb IDE flash disk

Communications

- One Gigabit Ethernet

- Integrated Gigabit Ethernet switch
- 12 CAN buses

I/O

- 128 x 16-bit 0-5V analog output channels (expandable to 192 channels)
- 32 x 16-bit analog input channels (e.g. +/-10mA Moog drive monitoring)
- 48 x digital I/O channels
- FPGA cards provide generation of crank and cam signals, and monitor TAG-320 ignition/injection timing and high/low side driver outputs. Feedback is provided via front panel LEDs and loads (10% of rated output)

Mounting

Standard harnesses are available for TAG-320, TAG-310B, Powerbox2006, CBT-610, PCU-6D and four HIU-3s (these units are not included). Option upgrades and harness packages are available for a HSL-500 unit. The system as a whole is a 9U rack.

Specification

Unit Signal Type	vTAG-RT System Connection	Comment
Wheel Speed Inputs	Connection to FPGA via signal conditioning	
Brake Temp/Hub Accel Inputs	Direct connection to DAC channel	
Caliper Temp PT1000 Input	Buffered connection to DAC channel	Under software control the input can be switched to allow full analog control.
Pushrod Load Inputs	Not connected	
Brake Wear LVDT Inputs	Not connected	

Unit Signal Type	vTAG-RT System Connection	Comment
Scope Outputs	Connection to ADC/FPGA and via BNC connector on front panel	
High Side Drive Outputs	Connection to FPGA via signal conditioning	Load is 10% of rated channel load.

Unit Signal Type	vTAG-RT System Connection	Comment
HDLC Comms	None	
CAN Comms	Connection to breakout connector on the backplane	

Unit Signal Type	vTAG-RT System Connection	Comment
Serial Comms	Direct connection to TAG-320	PCU-6D can be mounted on the Factory HIL front panel

CAN Comms	Connection to breakout connector on the backplane

Note: The system can be used with or without a Powerbox2006 connected.

Please consult our technical consultancy team for details of HSL-500 unit connectivity and additional HIL resources included in the upgrade packages for each.

Software Included

- Simple Simulink car model (source included)
- Simulink I/O Model (source included)
    - 20-2 crank/cam generation
    - Ignition/Injection pulse measurement
    - DHE PWM generation with quadrature for lay/mainshaft
    - DHE discrete tooth generation
    - Switched load state and PWM condition detection
    - Time synchronisation with TAG-320
- Simulink CAN card drivers
- Sample front panel software written in C# (source included)
- System Monitor licence
- One vTAG-RT licence

Software Requirements

Development of code for the Factory HIL vTAG-RT system requires the following:

- GDE v8.2
- vTAG-RT PSP (includes vTAG-RT runtime)
    - Simulink
    - Real Time Workshop with RTW Embedded Coder
    - xPC Target (required to rebuild I/O model)
    - Simulink
    - Simulink Coder
    - Embedded Coder
    - xPC Target (required to rebuild I/O model)

Ordercodes

Description	Ordercode
TAG-320 Factory HIL (Mainframe)	O 030 920 000 005
TAG-310 harness set	O 030 920 000 002
TAG-320 harness set + upgrade	O 030 920 000 006
HIU-3 and CBT-610 Harness set	O 030 920 000 012

Description	Ordercode
HSL-500 harness set + upgrade	O 030 920 000 004

Ignition/Injection

Ignition Driver Unit IGN-310

The IGN-310 is a compact inductive ignition drive unit which drives two banks of five ignition coils. The drivers are controlled via direct logic signals from a host ECU and provide fire-by-fire diagnostics back to that unit via CAN. The coils can be run at voltages up to 30V with this unit in order to minimize dwell times for optimum response.

In Detail

Application

- Driving ignition coils from logic signals from a host ECU.

Electrical

- Ignition Supply Voltage 14 to 30V DC (unit is protected against transient voltage spikes above 30V, sustained operation above 33V may cause permanent damage)
- Supply Voltage 7.5V to 16V
- Supply Voltage not to exceed 17V continuous (unit is protected against transients and reverse voltage protection is provided on the control circuitry)
- Supply Current operating 0.1A typ, 0.2A max
- Inductive 'flyback' from the coils can reach 400V or more, so provision of double or reinforced insulation and/or provision of a safety earth should be made to ensure safety wherever the possibility of contact with a live conductor exists.

Inputs

- 10 ignition trigger inputs, configurable via CAN as TTL mode or Open Drain mode
- 14 to 30V Power Supply to power the ignition coils
- 14V Power Supply for the processor and control circuitry

Outputs

- 10 Open Collector outputs for coils
- Two oscilloscope diagnostic

Communications

- One CAN link (1Mbps)

Diagnostics

- Fire-by-fire diagnostics on each injector comprise open circuit, open and short circuit status flags
    - Board temperatures
    - Unit and ignition supplies
    - OK threshold
    - Over current threshold
    - Internal 12V supply rail
    - Selected input pull up voltage

Connection definition

- Integral, sealed, military standard connectors
-

Ignition Bank A connector	8-way	HEN.2F.308.XLNP
Ignition Bank B connector	8-way	HEP.2F.308.XLNP
Main connector	19-way	HEP.2F.308.XLNP

- For PIN numbers please contact our technical consultancy department.

Mechanical

- Case material Magnesium alloy, chromate converted and painted with black epoxy
- Weight less than 220g

Environmental

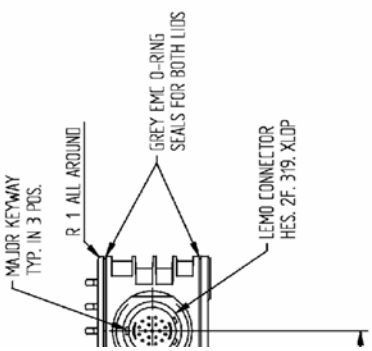
- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Mounting lugs are provided, vibration isolation is recommended
- Internal Temperature not to exceed 75°C as measured by internal diagnostic sensors – forced air cooling required
- Storage Temperature -10°C to +85°C
- Vibration 100 to 1000Hz, all axes, 24 hours

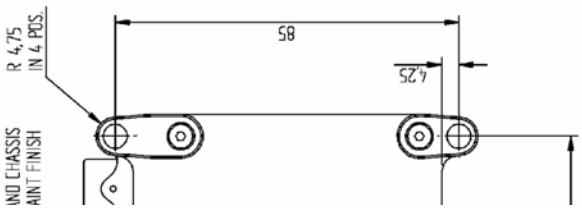
Electro Magnetic Compatibility

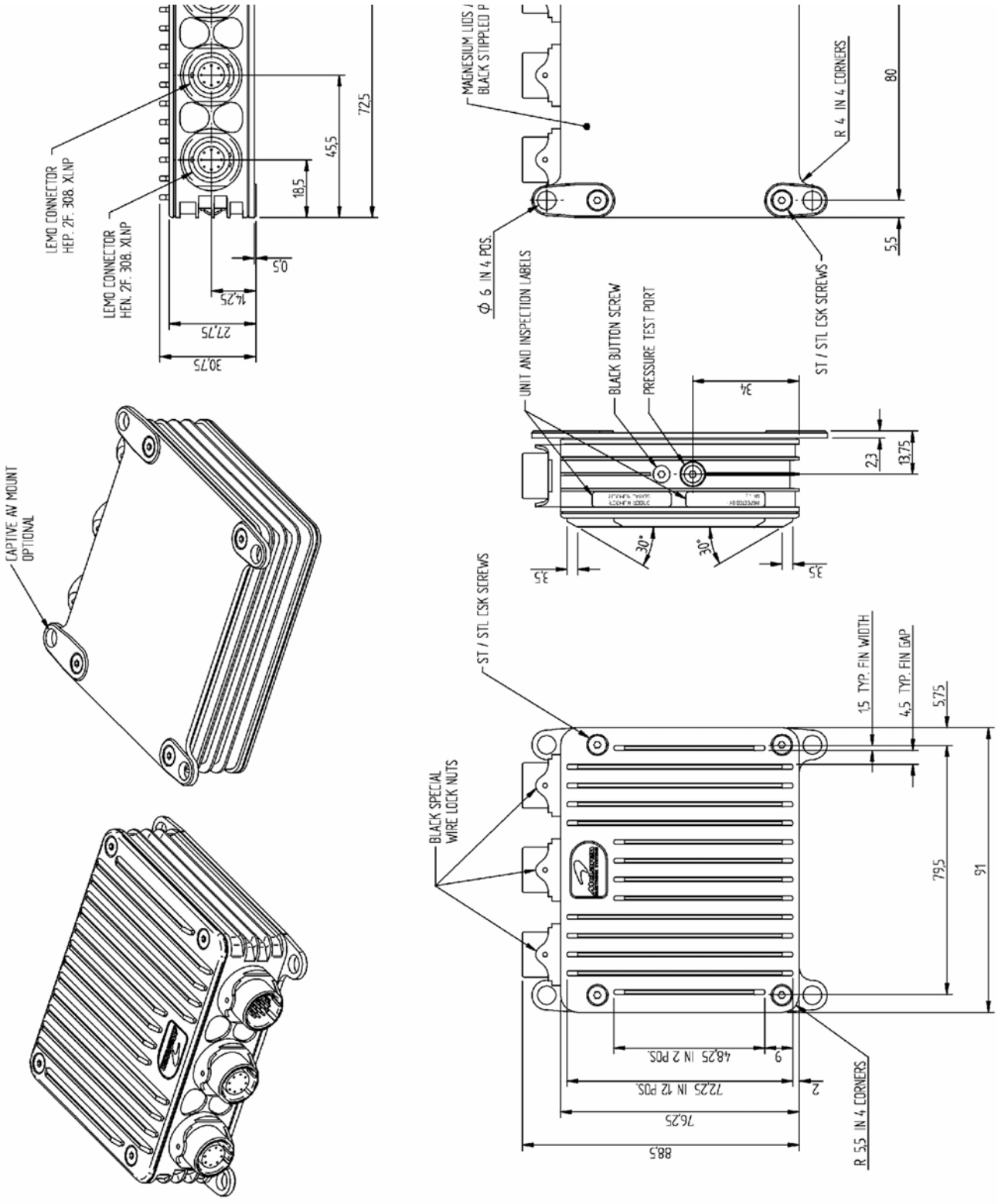
- Complies with the essential protection requirements of 89/336/EEC

Images/Diagrams

O 030 072 009 001







Ordercodes

Description	Ordercode
IGN-310 Unit	O 030 072 009 001

Injector Driver Unit INJ-320

The INJ-320 is a compact injection drive unit capable of driving ten fuel injectors at a nominal 90V, thus catering for the requirements of high pressure solenoid injectors. The unit generates the complex waveforms required to activate the injectors. These waveform characteristics are software configurable via CAN. Injectors are switched on via TTL pulses from the host ECU. A single-chip processor gathers and processes diagnostic information and deals with setting up the injector waveform parameters

In Detail

Electrical

- Supply Voltage 8 to 14V DC (Engine start capability only below 10.5V)
- 90V generated internally
- Reverse polarity protection

Inputs

- 10 TTL injection pulses
- Digital reference ground

Outputs

- 10 injector drives in bridge configuration – both ends of the injector are driven
- Two oscilloscope diagnostic

Communications

- One CAN link (1Mbps)

Diagnostics

- Fire-by-fire diagnostics on each injector comprise open circuit, open and short circuit status flags
    - Board temperatures
    - Unit and injector supplies
    - Internal supply rails

Application

- Driving injectors from logic signals from a host ECU
- Maximum injection rate is 1000/s (three per cycle for four cylinders at 10,000rpm). 13A peak & 500µs are maximum sustainable values at this rate.

Connection definition

- Integral, sealed, military standard connectors
-

Injector Bank A connector	10-way	HEP.2F.310.XLNP
Injector Bank B connector	10-way	HEN.2F.310.XLNP
Main connector	19-way	HES.2F.319.XDLP
Power connector	8-way	HES.2F.308.XDLP

- For PIN numbers please contact our technical consultancy department.

Mechanical

- Case material aluminium, black anodised
- Weight approx 1500g (estimated)

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Mounting lugs are provided, vibration isolation is recommended
- Internal temperature not to exceed 75°C as measured by internal diagnostic sensors – forced air cooling required
- Storage temperature -10°C to +85°C
- Operating ambient temperature 0 to +40°C
- Vibration 100 to 1000Hz, all axes, 24 hours

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 2004/108/EC

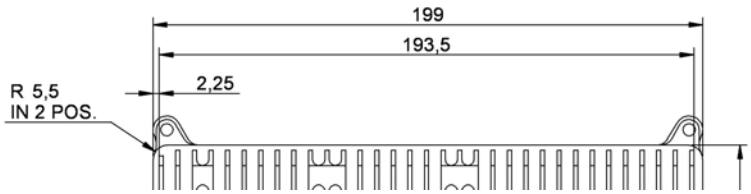
Limits on software configuration of waveform

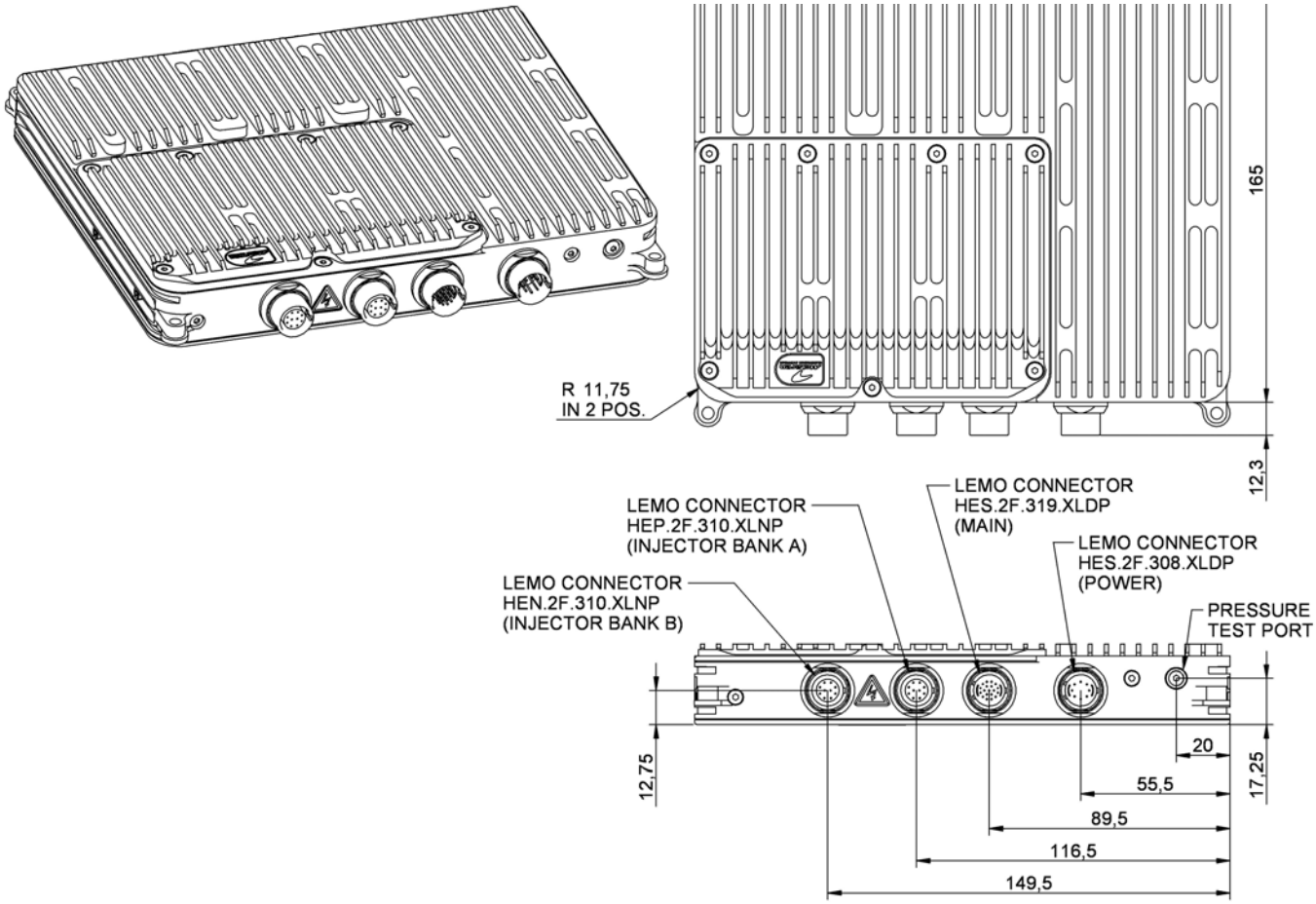
- Peak current – up to 25A
- Peak hold current – up to 15A
- Peak hold duration – up to 800µs
- Hold current – up to 10A

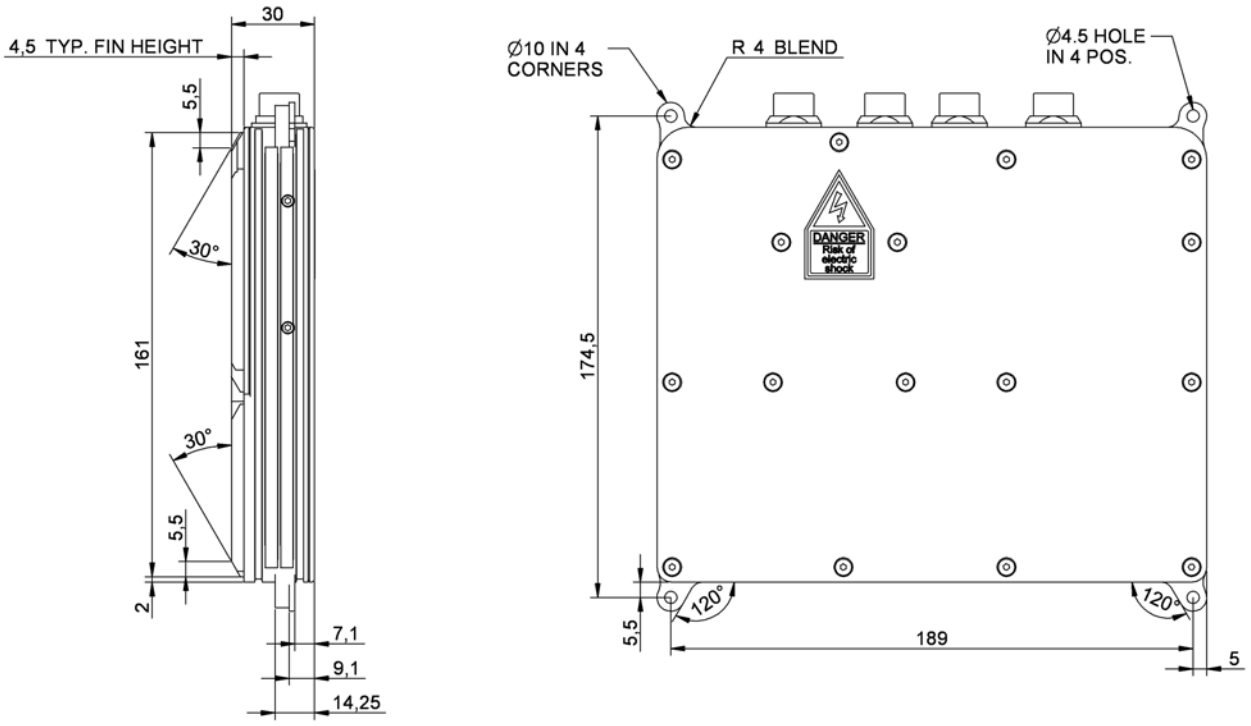
Permissible maximum values will be reduced for multiple injections per fire at high engine speeds in order to prevent over-heating of the 90V internal power supply

Images/Diagrams

O 030 072 011 003




R 11,75
IN 2 POS.
165
12,3
LEMO CONNECTOR
HEP.2F.310.XLNP
(INJECTOR BANK A)
LEMO CONNECTOR
HES.2F.319.XLDP
(MAIN)
LEMO CONNECTOR
HES.2F.308.XLDP
(POWER)
LEMO CONNECTOR
HEN.2F.310.XLNP
(INJECTOR BANK B)
PRESSURE
TEST PORT
12,75
20
17,25
55,5
89,5
116,5
149,5


4,5 TYP. FIN HEIGHT
30
5,5
30°
161
30°
5,5
2
7,1
9,1
14,25
Ø10 IN 4
CORNERS
R 4 BLEND
Ø4.5 HOLE
IN 4 POS.
DANGER
Risk of
electric
shock
174,5
120°
120°
5,5
189
5

Ordercodes

Description	Ordercode
INJ-320 Unit	O 030 072 011 003

Injector Driver Unit INJ-310

The INJ-310 is a compact injection drive unit capable of driving ten fuel injectors at voltages up to 90V, thus catering for the requirements of high pressure solenoid injectors. The unit generates the complex waveforms required to activate the injectors. These waveform characteristics are software configurable via CAN. Injectors are switched on via TTL pulses from the host ECU. A single-chip processor gathers and processes diagnostic information and deals with setting up the injector waveform parameters.

In Detail

Application

- Driving injectors from logic signals from a host ECU.

Electrical

- Supply Voltage 8 to 14V DC
- Injector Supply Voltage 14 to 90V. Provision of double or reinforced insulation and/or provision of a safety earth should be made to ensure safety wherever the possibility of contact with a live conductor exists.
- Injector Supply Voltage not to exceed 100V continuous (the unit is protected against transients and reverse polarity). Sustained operation above 95V may cause permanent damage due to internal overheating.

Inputs

- 10 TTL injection pulses
- Digital reference ground

Outputs

- 10 injector drives in bridge configuration – both ends of the injector are driven
- Two oscilloscope diagnostic

Communications

- One CAN link (1Mbps)

Diagnostics

- Fire-by-fire diagnostics on each injector comprise open circuit, open and short circuit status flags
    - Board temperatures
    - Unit and injector supplies
    - Internal supply rails

Connection definition

- Integral, sealed, military standard connectors
-

Injector Bank A connector	10-way	HEP.2F.310.XLNP
Injector Bank B connector	10-way	HEN.2F.310.XLNP
Main connector	19-way	HES.2F.319.XDLP
90V Power connector	5-way	HET.0F.305.XDLP

- For PIN numbers please contact our technical consultancy department.

Mechanical

- Case material Magnesium alloy, chromate converted and painted with black epoxy
- Weight less than 430g

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Mounting lugs are provided, vibration isolation is recommended
- Internal Temperature not to exceed 75°C as measured by internal diagnostic sensors – forced air cooling required
- Storage Temperature -10°C to +85°C
- Operating ambient temperature 0 to +40°C
- Vibration 100 to 1000Hz, all axes, 24 hours

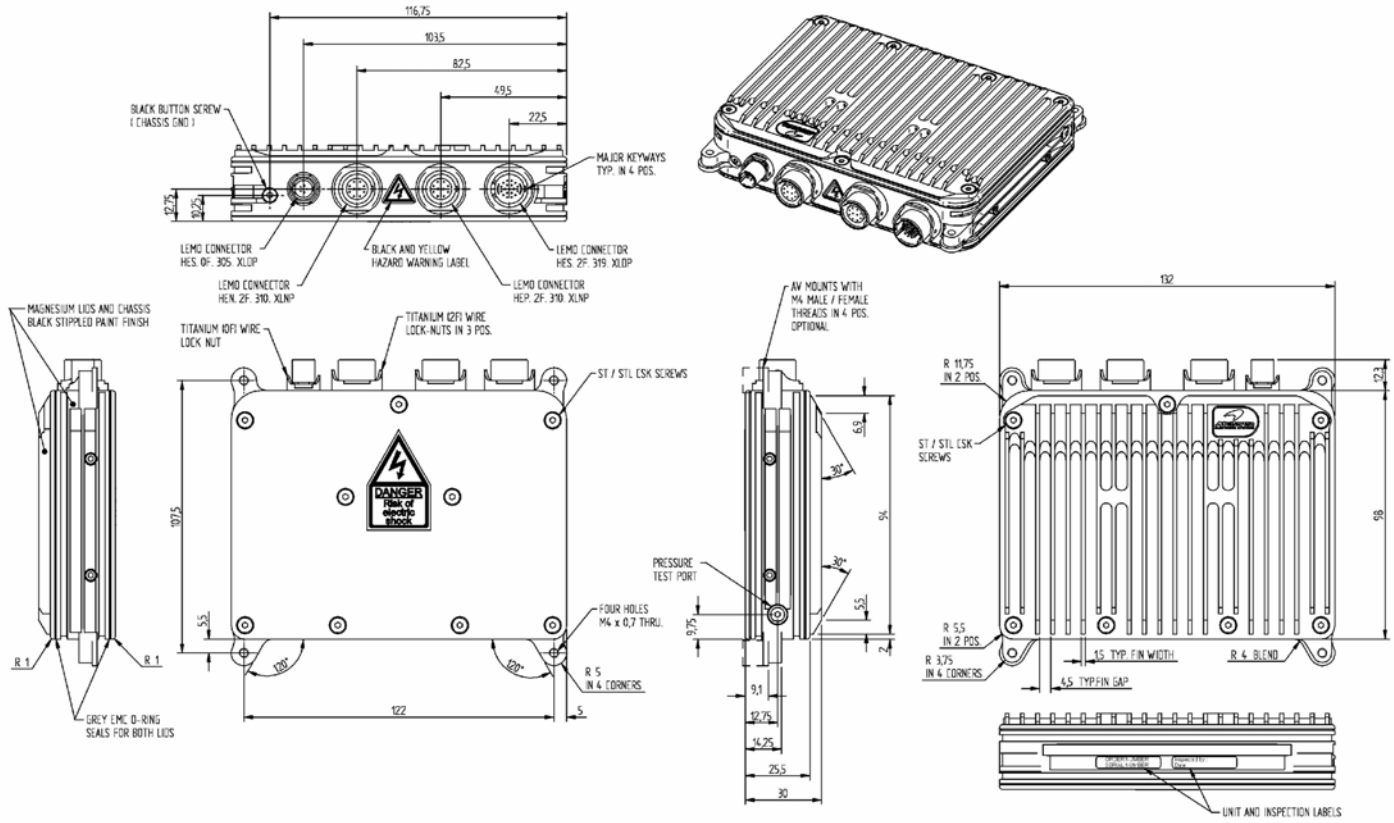
Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Images/Diagrams

O 030 072 011 001

INJ-310



Ordercodes

Description	Ordercode
INJ-310 Unit	O 030 072 011 001

Interface Units

Hub Interface Unit HIU-3

The HIU-3 is a local, micro-processor controlled sensor interface unit. It is small and light, designed to be mounted on the wheel hub, thus reducing the harnessing on the car. The unit can withstand the high radiated temperatures from the brakes whilst the car is stationary and the vibration from the wheels whilst the car is moving.

The data is transmitted to an appropriate control unit (such as the TAG-400 or MCU-300) over a two-wire CAN bus communication link.

In Detail

Application

- Localised data acquisition.

Electrical

- Supply Voltage 12V to 16V DC (full operation), 7.5V to 11.99V (with some parameter inaccuracies)
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Current 150mA typical at 13.8V (including typical transducer loads)

Mechanical

- Hard black anodised aluminium
- Weight approximately 55g

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 2004/108/EC

Connection Definition

- Integral, sealed, LEMO series F motorsport connectors
-

Connector 1	8-way	HES1F308XLDP
Connectors 2 to 5	4-way	HEN.FF.304.SLNP

- For pin numbers please consult our Technical Consultancy service

Environmental

- Splash resistant to standard motorsport fluids

- Lids and screws sealed with silicone sealant, lid o-ring sealed
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Internal Temperature not to exceed 115°C as measured by internal diagnostic sensor. If necessary, cooling for the unit should be applied so the temperature remains within these limits
- Storage Temperature -10°C to +125°C
- Vibration 100 to 1000Hz, all axes, 24 hours
- Vibration isolation is recommended

Sensor Inputs

- Two LVDT sensor interfaces (12-bit)
- Two 0-5V Analogue inputs (12-bit)
- One differential amplified load cell interface (or two unity gain 0-5V analogue inputs)
- Two DHE wheel speed input
- One PT1000 temperature input (12-bit)

Outputs

- One protected car supply output rated at 30mA for Hub accelerometer
- One 10V 10mA reference supply for load cell transducer

Communications

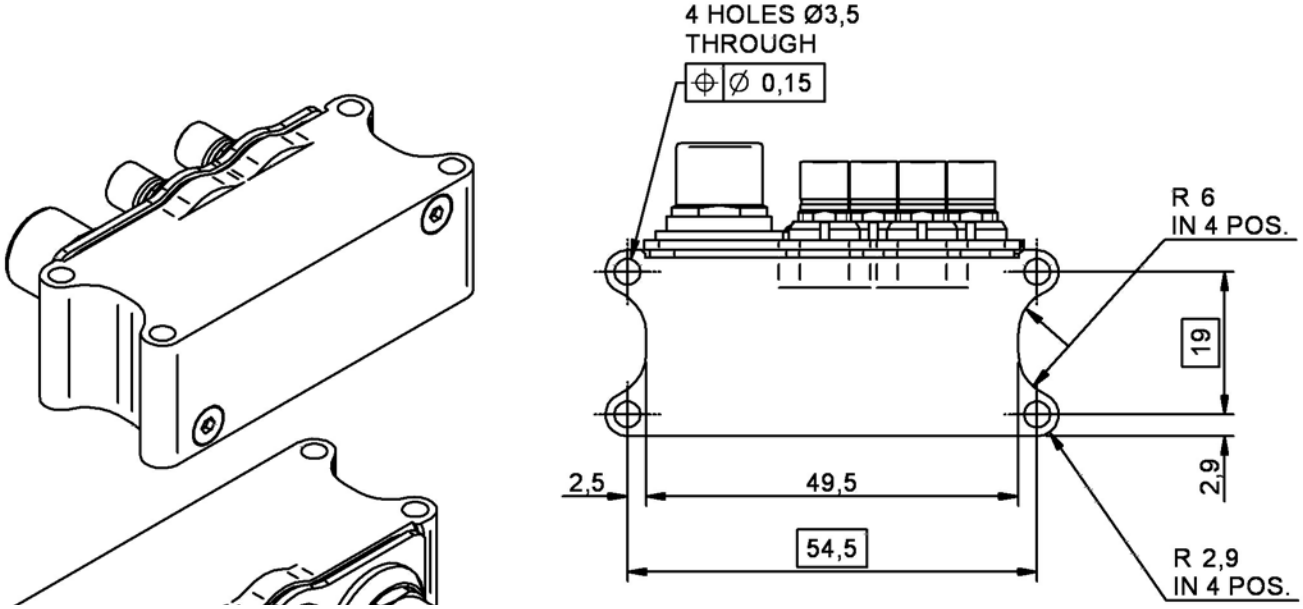
- One CAN bus interface, 1Mbaud as standard
- One time synchronous trigger input

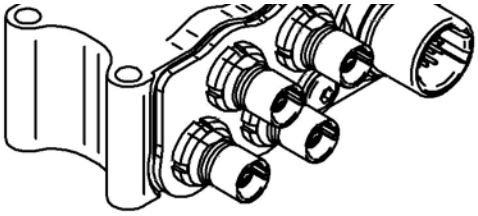
Diagnostics

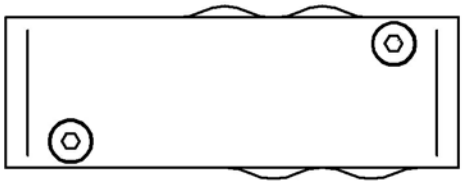
- Internal diagnostic supply voltage and temperature sensor

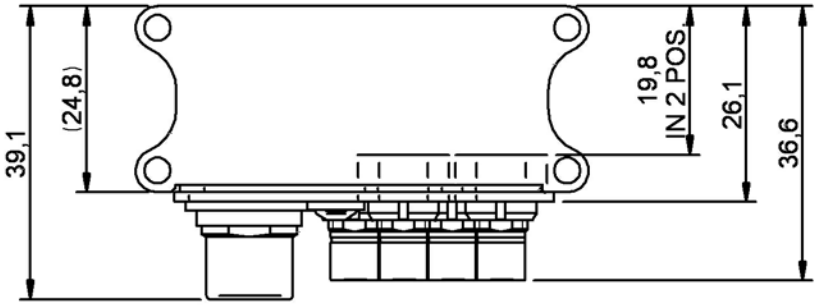
Images/Diagrams

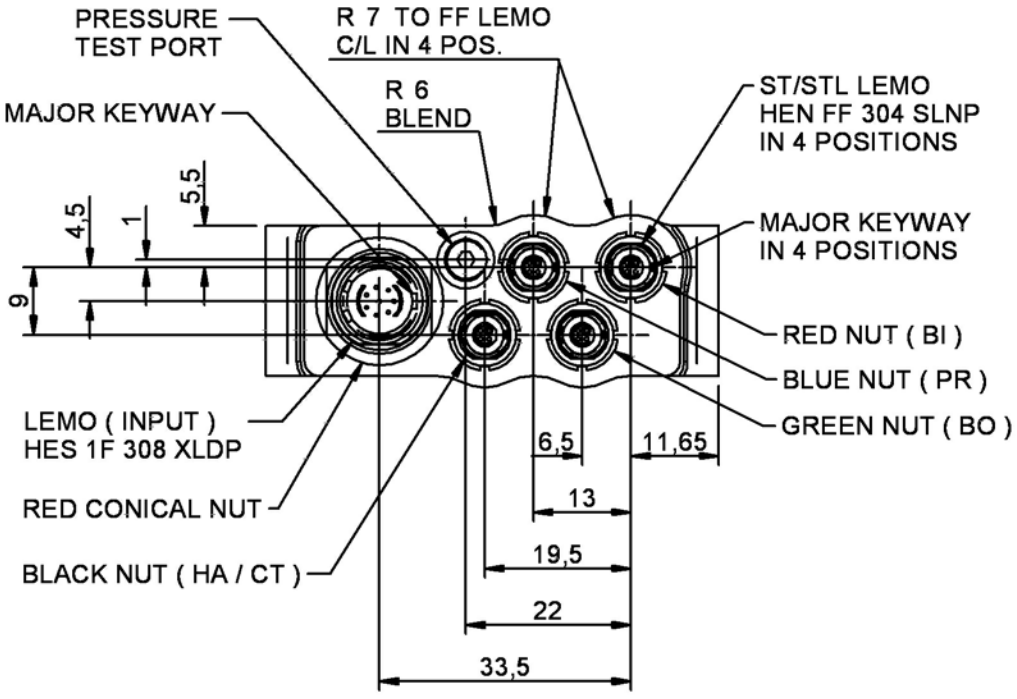
O 030 110 008 002











Ordercodes

Description	Ordercode
HIU-3	O 030 110 008 002

Lambda Measurement SN-32LT

The SN-32LT is an intelligent, microprocessor controlled, data acquisition and lambda measurement unit for up to 6 wide band UEGO sensors. It is based on the SN-32 sensor node and can be used as part of the DATA

SN-32LT has a single Sensor Bus and a CAN communication bus. It does not include heater drivers but has a control output for a separate heater unit.

In Detail

Application

- Wide-band Lambda measurement.

Electrical

- Supply 7.5V to 16.0V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Supply Current 250mA typical @12V
    - 20 MHZ
    - On-chip CAN 2.0B controller
    - 2M HDLC sensor bus link
    - 8M HDLC link to control processor
    - 64kbyte Flash ROM
    - 64kbyte SRAM

Mechanical

- Case material Magnesium alloy, chromate converted and painted with black epoxy
- Weight less than 220g

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Connection Definition

- Integral, sealed, LEMO series F motorsport connectors
-

Connector A	22-way	HEN3F322XLNP

Connector B	22-way	HEP3F322XLNP
Connector LAM	22-way	HES3F322XLDP
Connector IN	22-way	HES1F308XLNP
Connector OUT	22-way	HEN1F308XLDP

For pin numbers, please contact our Technical Consultancy Department

Environmental

- Splash resistant to standard motorsport fluids
- Lids and screws sealed with silicone rubber
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Internal temperature not to exceed 70°C as measured by internal diagnostic sensors
- Storage temperature -10 to 85°C
- Vibration 100 to 1000 Hz, all axes, 24 hours

Connector Diagrams

False

Sensor Inputs

- Six UEGO lambda sensors
- Four DHE speed sensors
- Five analogue (0 to 5V, 12-bit, 1kHz)
- Seven analogue (0 to 5V, 10-bit, 125Hz) four of these can be configured for PT1000 temperature sensors
- 10 K-type thermocouples

Outputs

- One High side driver (0.7A) used to control heater unit

Communications

- DATA
- CAN 2.0B bus (up to 1Mbps)

Diagnostics

- Sensor readings are checked for out of range and open circuit
    - Board temperatures
    - Unit supply voltages
    - External 5V supply voltages and currents

For more details, please contact our Technical Consultancy Department

Ordercodes

Description	Ordercode
SN-32LT	O 030 095 006 004

Sensor Interface Unit SIU-3

The SIU-3 three channel CAN interface unit is used to translate the voltage output from up to three sensors and transmit over CAN to the host controller and/or logger.

In Detail

Application

- Interface to remote sensors.

Electrical

- Supply voltage 8 to 16V unregulated
- This supply is also the unregulated sensor supply
- Regulated sensor supply: 5V±10mV, 50mA max total
- Supply current (without sensors connected) 105mA max (90mA typ at 13.8V)
- Reverse polarity protection

Inputs

- Sensor inputs 0-5V. The output will read 5V for any input 5V or higher

Communications

- 1Mbit/s CAN communications link for configuration and results data
- CAN sampling rate configured by host ECU up to 1kHz
- CAN message identifiers configured by host ECU allowing multiple modules sharing a common bus (a fixed CAN identifier will be required for configuration messages)
- CAN bus link must be terminated using 120ohm resistor

Mechanical

- Weight less than 80g
- Aluminium body hard anodised and dyed black

Environmental

- Resistant to standard motorsport fluids
- Lid sealed with silicon o-ring
- Operating temperature 0 to +115°C

- Storage temperature -10 to +125°C
- Vibration 100 to 1000Hz, all axis, 24hours

Connection Definition

- 3x Interface inputs 4 way Lemo ECN.FF.304.SLM, blue, green and black nut
-

Pin 1	Sensor supply (unregulated)
Pin 2	Signal
Pin 3	Ground
Pin 4	Sensor supply (regulated)

- Interface output 4 way Lemo ECS.FF.304.SLC, red nut
-

Pin 1	Supply
Pin 2	CAN +
Pin 3	CAN -
Pin 4	Ground

- 3x Interface inputs 8STA0-02-05SA Connectors B, C and D
-

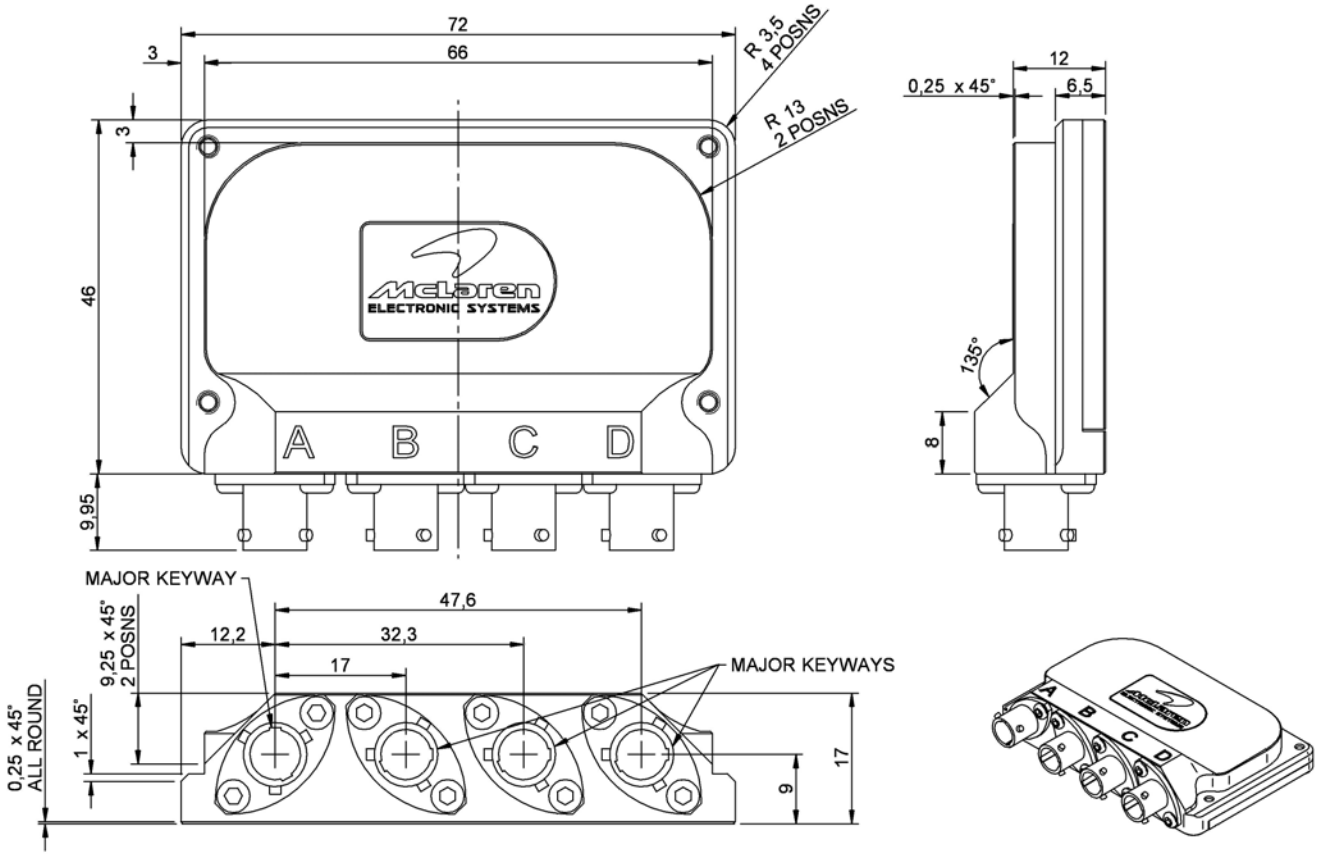
Pin 1	Sensor supply (unregulated)
Pin 2	Signal
Pin 3	Ground
Pin 4	Sensor supply (regulated)
Pin 5	N/C

- Interface output 8STA0-02-05PN Connector A
-

Pin 1	Supply
Pin 2	CAN +
Pin 3	CAN -
Pin 4	Ground
Pin 5	N/C

Images/Diagrams

O 030 200 010 002



Ordercodes

Description	Ordercode
Three channel CAN Interface unit with Lemo connectors	O 030 200 010 001
Three channel CAN Interface unit with Souriau connectors	O 030 200 010 002

Sensor Node SN-32

The SN-32 is an intelligent, microprocessor controlled, data acquisition unit. A range of analogue, speed and thermocouple measurements are sampled at rates of up to 1kHz. The results are transmitted back to the host unit via CAN or HDLC link for logging or control.

SN-32 is configured by System Monitor.

In Detail

Application

- Chassis monitoring.

Electrical

- Supply Voltage 7.9 to 16.0V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Supply Current 100mA typical @ 12V
    - 20MHZ
    - On-chip CAN 2.0B controller
    - 2M HDLC sensor bus link
    - 64kbyte Flash ROM
    - 64kbyte SRAM

Service

- Recommended service interval 12 months (internal battery is replaced)

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Connection Definition

- Integral, sealed, LEMO series F motorsport connectors
-

Connector A	22-way	HEN3F322XLNP
Connector B	22-way	HEP3F322XLNP
Connection In	8-way	HES1F308XLNP

Connection Out	8-way	HEN1F308XLN

- For pin numbers please request Product Specification EDD 99-04

Mechanical

- Case material Magnesium alloy, chromate converted and painted with black epoxy
- Weight less than 150g

Environmental

- Splash resistant to standard motorsport fluids
- Lids and screws sealed with silicone rubber
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Internal Temperature not to exceed 85°C as measured by internal diagnostic sensors
- Storage Temperature -10°C to 85°C
- Vibration 100 to 1000Hz, all axes, 24 hours

Connector Diagrams

False

Sensor Inputs

- Four DHE Speed Sensors
- Nine analogue (0 to 5V, 12-bit, 1kHz)
- Six analogue (0 to 5V, 10-bit, 1kHz)
- Seven analogue (0 to 5V, 10-bit, 125Hz)
- Four analogue (0 to 5V, 10-bit, 125Hz can be configured for Pt1000 temperature sensors)
- Two K-type thermocouples (uses pairs of input connections)

Communications

- One HDLC Sensor bus (2Mbps)
- One CAN 2.0B bus (up to 1Mbps)

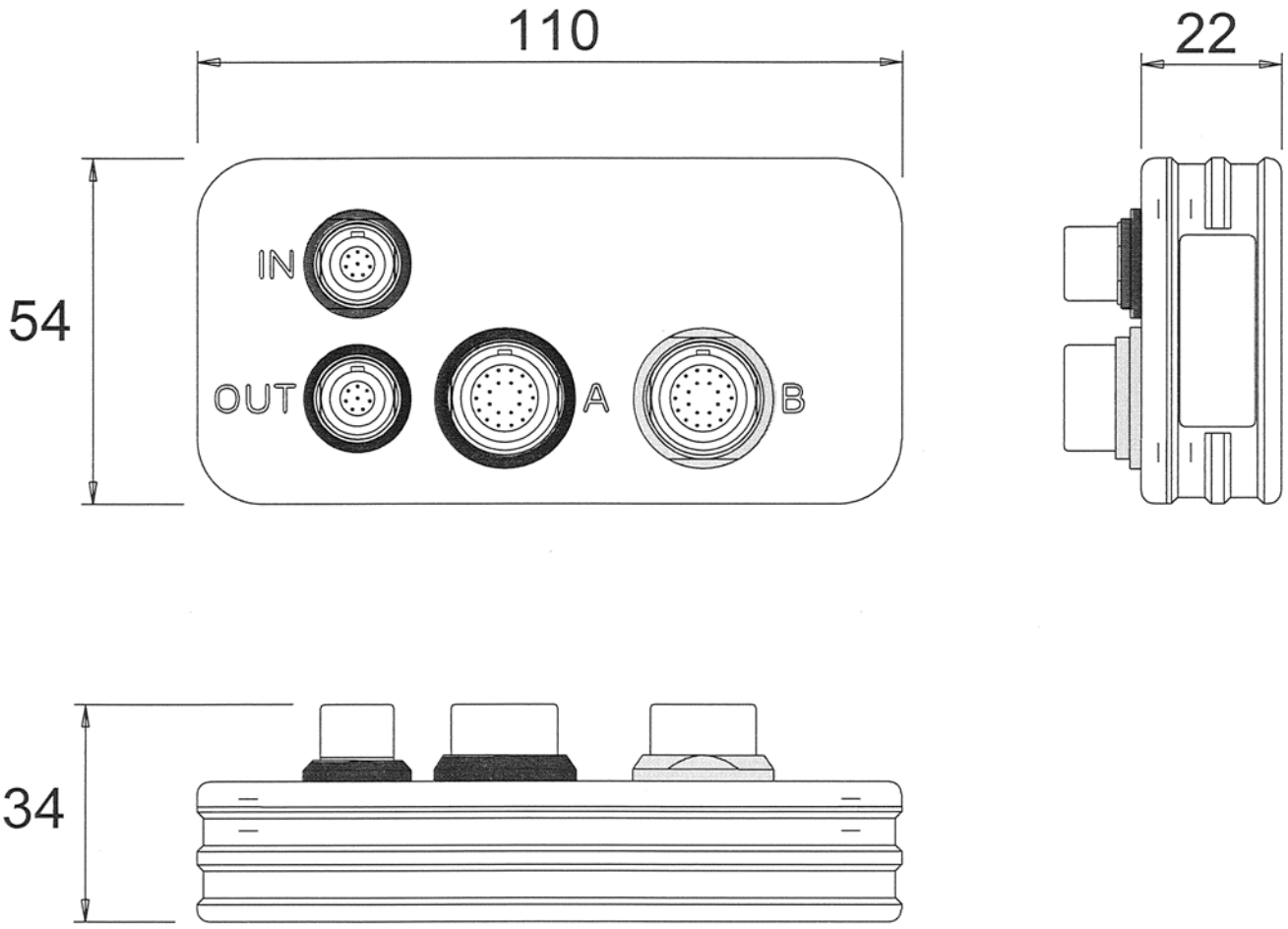
Diagnostics

- Sensor readings are checked for out of range and open circuit
    - Board temperatures
    - Unit supply voltages
    - External 5V supply voltages and currents

For more details, please request our Product Specification EDD 99-04.

Images/Diagrams

O 030 095 006 000



Ordercodes

Description	Ordercode
SN-32	O 030 095 006 000

Sensor Node SN-320

The SN-320 is an intelligent, microprocessor controlled data acquisition unit. A range of analogue, thermocouple and speed measurements are sampled at rates of up to 10ksps. The results are transmitted back to the host unit via CAN or FlexRay for logging or control.

SN-320 is configured by System Monitor.

In Detail

Application

- Chassis or engine monitoring.

Electrical

- Supply Voltage 7.5 to 16V DC
- PowerPC data acquisition processor operating at 130MHz, with 1MB Flash and 192kB SRAM on chip

Inputs

- 24 analogue inputs for 0V-to-5V measurement (12 configurable for Pt1000), 12-bit resolution, up to 10ksps
- Four K-type thermocouple inputs, 12-bit resolution
- Six DHE speed inputs
- One RS422 time synchronisation input

Outputs

- Two individual, protected 5V sensor supplies
- One protected 10V sensor supply

Communications

- One CAN interface (up to 1Mbps)
- One dual-channel Flexray interface (20Mbps)

Connection Definition

- Souriau double-density connectors
-

Connector A (host)	12-way
Connector B (sensors)	26-way

Connection C (sensors)	26-way

Mechanical

- Case material machined magnesium alloy, painted black (stippled)
- Weight less than 150g

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings and screws sealed with silicone rubber
- Maximum humidity 95% non-condensing
- Minimum operating temperature 0°C
- Internal Temperature not to exceed 85°C as measured by internal diagnostic sensors
- Storage Temperature -10°C to +85°C
- Vibration 100 to 1000Hz, all axes, 24 hours

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Service

- Recommended service interval 12 months

Connector A

- Unit supply input
- External reset input
- CAN and FlexRay ID/slot configuration inputs (selection via external resistors to ground)
- CAN
- Dual-channel FlexRay

Connector B

- 12 analogue inputs for 0V-to-5V measurement (six configurable for Pt1000)
- Four K-type thermocouple inputs
- Two individual, protected 5V sensor supplies

Connector C

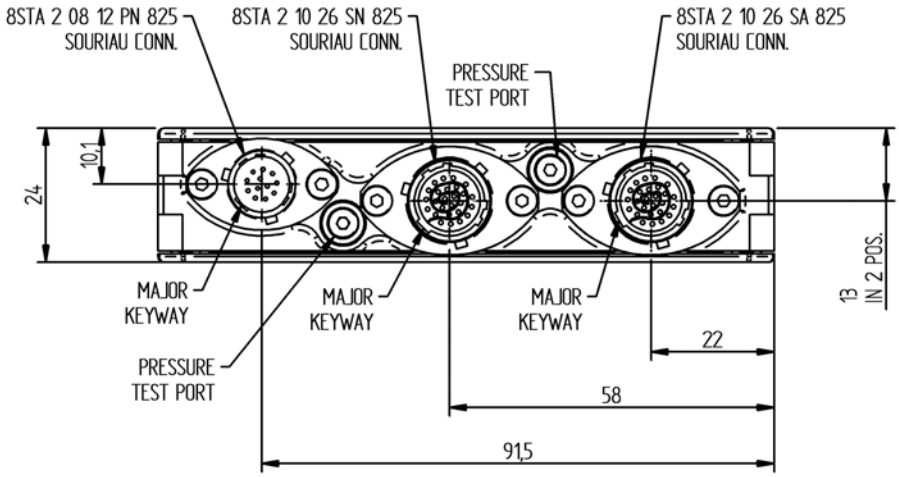
- 12 analogue inputs for 0V-to-5V measurement (six configurable for Pt1000)
- Six DHE speed inputs
- Two individual, protected 5V sensor supplies
- One protected 10V sensor supply

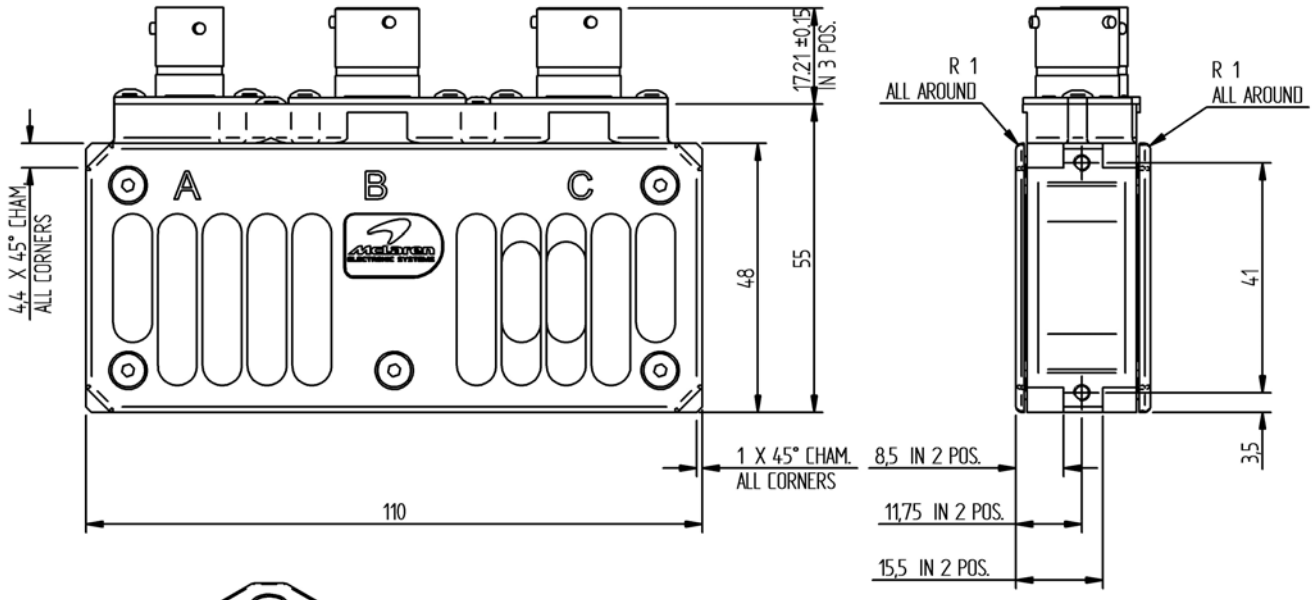
Diagnostics

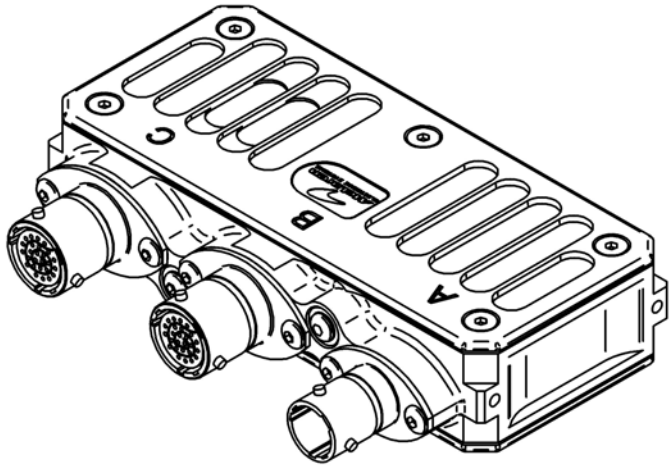
- Inputs are checked for out-of-range and open-circuit conditions
- Internal temperatures, unit supply input and sensor supply output voltages are monitored

Images/Diagrams

O 030 095 020 000

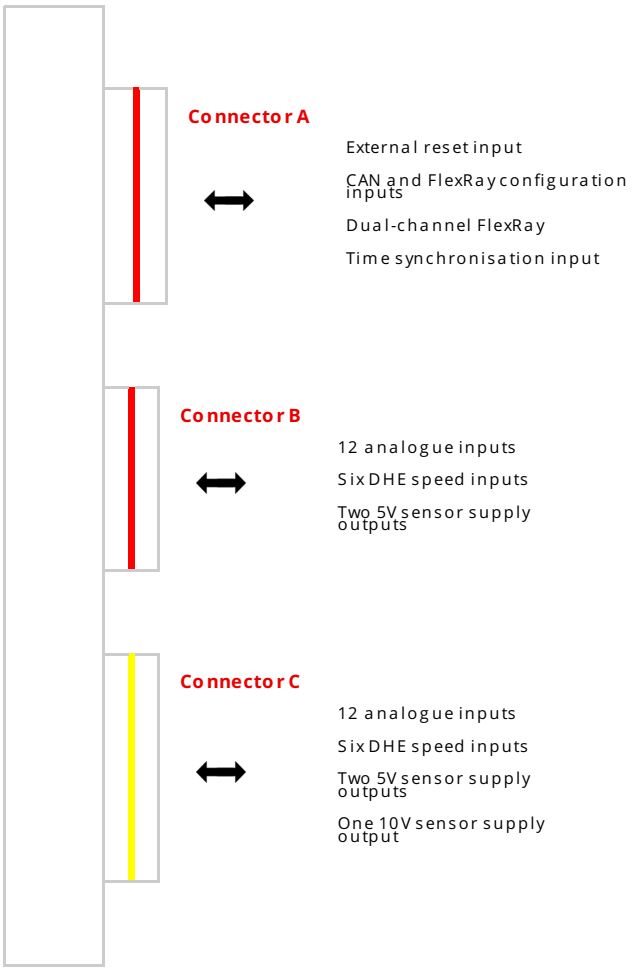






Connector Diagram

Connector Details



Ordercodes

Description	Ordercode
SN-320	O 030 095 020 000

Steering Wheel Interface Unit SIU-300

The SIU-300 Steering Wheel Interface Unit is a local sensor and switch interface unit designed to become an integral part of an assembly such as a racing car steering wheel. All sensor/switch data is linked by CAN to a main control unit which reduces the harnessing while expanding the analogue and digital input capabilities of the system.

In Detail

Application

- Interface to remote sensors and switches, for example: controls on steering wheel.

Electrical

- Supply Voltage 11.0 to 16.0V DC (full operation) 7.0V to 11.0V (full operation except external 10V strain gauge supply)
- Supply Voltage not to exceed 17V continuous (unit is protected against transients and reverse polarity)
- Supply Current operating 90mA typical @ 13.8V including typical transducer loads (user defined LEDs off)

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 2004/108/EC

Mechanical

- Weight less than 40g (as a subassembly)
- Main board dimensions 65mm x 65mm

Connection Definition

- O 030 110 006 004 comprises a processor board and interconnection board joined together via a detachable, flexible connection
- O 030 110 006 005 comprises the processor board only without the interconnection board
- For connection descriptions, please consult our Technical Consultancy service.

Diagnostics

- One internal diagnostic temperature sensor
- One internal diagnostic 5V output supply
- One internal diagnostic vehicle supply voltage

Inputs

- 18 digital switch inputs
- 11 0 to 5V analogue inputs
- One amplified steering torque strain gauge interface
- One reset input
- Two external switch inputs (not internally sampled) with an internal connection to the external switch output

Outputs

- One 10V output supply for strain gauge transducer
- One 5V supply for potentiometers and transducers
- Three user defined high side LED drivers
- One external switch output

Communications

- One CAN bus interface, 1Mbps

Environmental

- Minimum Operating Temperature 0°C
- Board Temperature not to exceed 70°C
- Storage temperature -10 to +125°C
- Vibration 100 to 1000Hz, all axes, 24 hours

Ordercodes

Description	Ordercode
SIU-300 – all boards and flexible interconnector	O 030 110 006 004
SIU-300 – single processor board without flexible interconnect	O 030 110 006 005

Thermocouple Interface Unit TIU-32

The TIU-32 is a 32-channel thermocouple interface unit. Two versions are available, the TIU-32 and the TIU-32C providing output as either 0-5V analogue or via CAN.

Cold junction is provided with the TIU-32 and TIU-32C. In the case of the standard TIU-32 the 32 compensated signals are then multiplexed (32:2) to provide two 0-5V scaled outputs. Channel selection is under the control of a host ECU via 4 channel select pins.

The TIU-32C CAN-linked version is fitted with a microcontroller that samples the analogue signals and scales them accordingly ready for transmission to a control unit via the CAN bus at speeds up to 1Mbps

In Detail

Application

- Multiple channel temperature monitoring.

Electrical

- Supply Voltage 7V to 17.5V
- Supply Voltage must not exceed 17.5V continuous (the unit is protected against transients and reverse polarity)
- Current 95mA maximum (70mA, typ)

Mechanical

- Case material Magnesium alloy, finished with stippled black epoxy
- Weight less than 155g

Sensor Inputs

- 32 analogue Type 'K' thermocouple inputs, -50°C to +1300°C nominal sensor range, cold-junction compensated, open circuit detection (1M pull-up to 160mV)
- Four digital channel select inputs (10k pull-downs), 5V clamp, can be driven from TTL or Moog output

Outputs

- Two 0-5V outputs (16 multiplexed outputs per channel)
- Nominal scale 60mV at -50°C, 230mV at 0°C, 3.944V at 1000°C
- Outputs can be scaled and transmitted via a CAN link at 1Mpbs

Connection Definition

- Integral, sealed, LEMO series F motorsport connectors

Connector 1	22-way	HEN3F322XLNP
Connector 2	19-way	HES2F319XLDP

- For pin numbers, please contact our Technical Consultancy Service

Electro Magnetic Compatibility

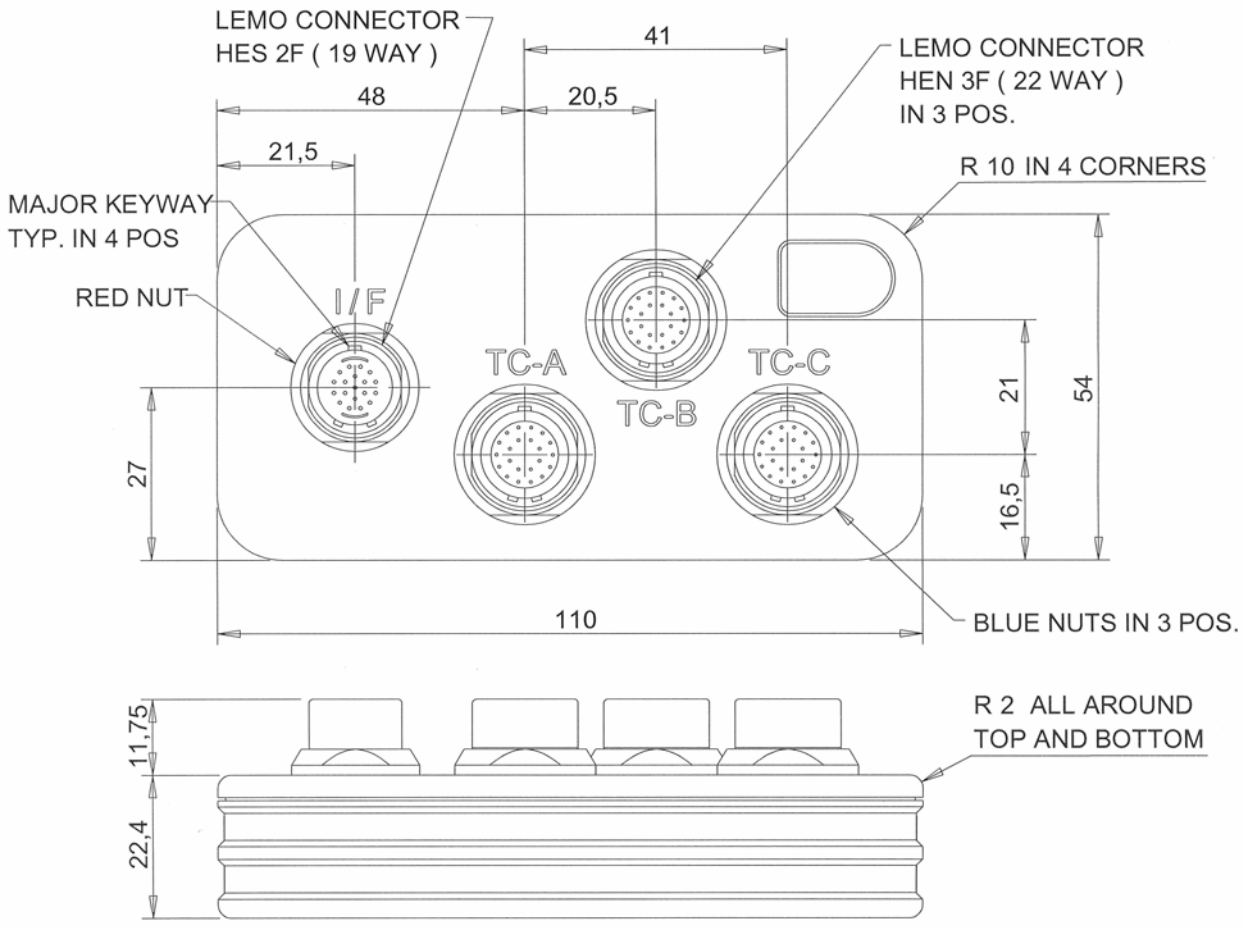
- Complies with the essential protection requirements of 89/336/EEC

Environmental

- Splash resistant to standard motorsport fluids
- Lid and screws sealed with silicone sealant, lid o-ring sealed
- Maximum humidity 100%
- Operating temperature -50°C to +70°C
- Storage Temperature -50°C to +85°C
- Vibration 100 to 1000Hz, all axes, 24 hours
- Care must be taken to shield the TIU-32 from draughts and sources of direct heat, as uncompensated errors will occur if the unit is subjected to thermal gradients or operated in an unstable ambient temperature.

Images/Diagrams

O 030 095 008 XXX



Ordercodes

Description	Ordercode
TIU-32	O 030 095 008 001
TIU-32C (CAN linked)	O 030 095 008 002

Lap Triggers

LRX-320 Narrowband Reciever Microwave Lap Trigger

The LRX-320 is a narrowband variant of the LRX-310B microwave lap trigger receiver featuring enhanced rejection of signals on neighbouring frequencies. This makes it particularly suited to operation in the presence of other on-car microwave transmitters.

The LRX-320 is a small, lightweight, microwave receiver with integral antenna. It outputs trigger pulses to an ECU as it passes through the beam of a track-side LTX-320 Lap Trigger transmitter. The pulse characteristics are related to the transmitter settings and can thus allow the ECU to identify which particular transmitter the receiver is passing.

In Detail

Electrical

Characteristics assume use with an LTX-320 Lap Trigger Transmitter.

- Supply Voltage 5.0±0.25V DC
- Operating frequency 11.71 ± 0.03GHz
  (Insensitive to LTX-310B transmitter)
- To avoid interfering with lap trigger operation, the band 11.71 ± 0.20GHz must be kept free of all other emissions
- Beamwidth between -3dB points (Vout 2.5V):
  ±15.5° horizontal
  ±35° vertical
- Range approximately 25m (when properly aligned)
- Supply current 130mA max with 5.0V supply
- Output characteristics :
  Impedance <60Ohm (<10mA sink/source)
  Max voltage outside LTX beam 150mV
  Max voltage inside LTX beam 4.75 to 5.25V (depending on unit supply voltage)
- Output voltage reflects signal strength as antenna passes through LTX beam
- Output voltage pulses low to <0.15V for 100±10us with interval between falling edges set by LTX.
- Valid pulse intervals are in the range 456-1576us
  (36 unique intervals in 32us steps)

- Response time <2ms
  (Time to first pulse after entering LTX beam)
- The LRX-320 cannot itself distinguish between different transmitter settings. This task must be performed by software in the ECU

Electro Mechanical Compatibility

- Complies with the essential protection requirements of 2004/108/EEC

Application

- Lap timing when used with compatible ECU and track-side transmitter

Connector Definition

- EHS 0F 303 XLC case-mounted Lemo socket with male pins

Pin 1	Supply
Pin 2	Ground
Pin 3	Output

Mechanical

- Case material: aluminium alloy
- Blue anodised to distinguish from black LRX-310B
- Antenna covered by 75um thick PTFE/fibreglass tape
- Weight approx 80g
- Mounted using 2-off M3 tapped holes on rear of case

Environmental

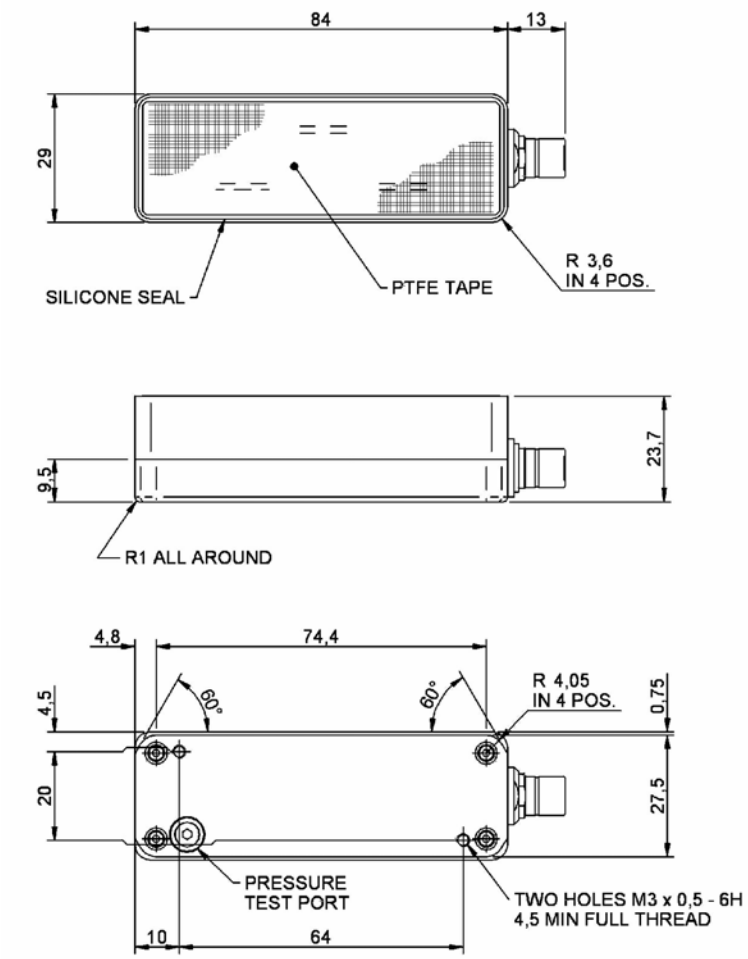
- Splash resistant to standard motorsport fluids
- Operating Temperature 0°C to +85°C
- Storage temperature -25 to +85°C
- Bump tested to ±50g ½ sine 11ms 5 times per axis
- Random vibration with spectrum below, 3 axes, 24hrs

100Hz	0.00797 g^2/Hz
200Hz	0.17157 g^2/Hz
300Hz	0.54279 g^2/Hz
650Hz	0.00965 g^2/Hz
1000Hz	0.02080 g^2/Hz

Images/Diagrams

O 030 040 004 000

LRX-320



Ordercodes

Description	Ordercode
LRX-320	O 030 040 004 000

Microwave Transmitter LTX-310B

LTX-310B is a self-contained microwave transmitter for use with the LRX-310B receiver. The output is pulse modulated to identify one of 36 channels arranged in six groups of six. The group is set at the factory and you can select one of the six channels in that group from an external rotary switch.

The internal, sealed, lead-acid battery typically produces eight hours of operation. An additional external battery can be connected for longer durations. The unit has a threaded socket for tripod mounting. A key switch is provided to allow unattended operation. LTX-310B is not suitable for mounting in a vehicle.

In Detail

Application

- Lap trigger timing when used with LRX-310B receiver.

Electrical

- Operating supply 8.0 to 14.4V DC
- Battery charging supply 13.8 to 14.4V DC not to exceed 0.8A (key switch can be on or off)
- LED indicates power on
- Operating centre frequency 10.6 ±0.05GHz
- RF Bandwidth <10MHz
- Output power +14 to +17dBm peak power input to antenna
- Beamwidth 3dB 18° (approx) horizontal and vertical
- Beamwidth 10dB 30° (approx) horizontal and vertical
- Antenna gain 20dBi ±1 dB
- Range approximately 25m (when properly aligned)
- Polarisation linear vertical
- Channel identification by modulation frequency (see Application Note for values

Electro Magnetic Compatibility

The unit has been designed and manufactured such that:

- The electromagnetic disturbance generated does not exceed the level above which radio and other equipment operating outside the RF band used by the LTX-310B cannot operate as intended;It has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable

degradation of its intended use.

- It has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

A site-specific radio licence should be obtained before the LTX-310B unit is operated outside an electromagnetically sealed environment.

Service

- Recommended service interval 24 months (internal battery is replaced)

Cable and Connection Definition

- Connection ASL0-06-05SN-HE
-

Pin 1	Battery supply +ve
Pin 2	Ground
Pin 3,4,5	N/C

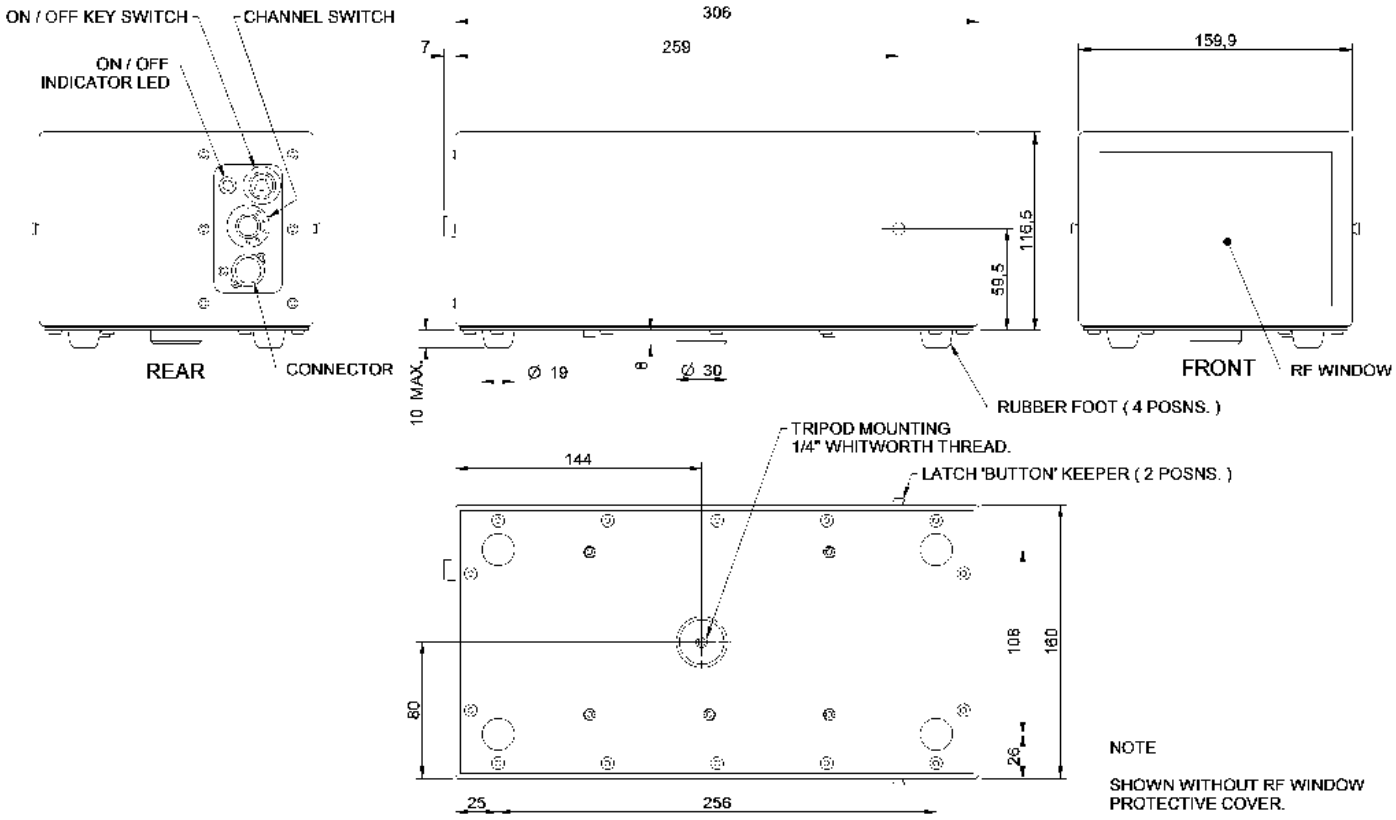
Mechanical

- Case material aluminium alloy, painted black, stippled epoxy polyester
- Antenna cover epoxy glass fibre composite
- Weight 3.6kg including cover and internal battery

Environmental

- Splash resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0°C to 50°C
- Storage temperature -20 to 50°C
- Store with battery charged. Top up charge every three months if unit is not being used.

Images/Diagrams



Ordercodes

Description	Ordercode
LTX-310B Microwave Transmitter	O 030 030 001 004

Loggers

Embedded PC Logger EPL-310

The EPL-310 Embedded PC Logger is a local data acquisition unit for automotive applications designed to provide data capture from USB devices such as onboard cameras.

The unit is based around a 1.6GHz Intel® Atom™ processor running the Microsoft Windows XP Embedded operating system. Applications for on board data processing may be developed using the McLaren Electronics GDE products run under the vTAG execution environment. vTAG provides functionality for data processing and data acquisition for subsequent upload to ATLAS.

In Detail

Application

- Data logging applications requiring data capture from USB devices such as onboard cameras.

Electrical

- Supply Voltage +9.0 to +16.0V DC
- Reverse polarity input protection provided on the supply
- Supply Current 0.80A (typical) at 13.8V

Communications

- One Ethernet (100BaseTX)
- One CAN bus interface, operating at up to 1Mbps
- One RS232 (PC COM1)
- Four USB 2.0

Other features

- VGA for direct connection to a display screen
- Intel® Atom™ series microprocessor operating at 1.6GHz
- 1GB DDR2 RAM
- 2GB Flash memory for Windows XPe and program storage
- 32GB Flash memory for data acquisition storage
- Capable of logging camera images up to 100Hz

Mechanical

- Case material magnesium alloy finished with black epoxy polyester, stippled

- Weight 545g

Connection Definition

For pin numbers please contact our technical consultancy department

Environmental

- Splash resistant to standard motorsport fluids
- Lid is sealed to the case, all through-case fixings sealed with silicone sealant, sealed motorsport connector
- Operating temperature 0 to +70°C
- If necessary cooling should be applied to ensure temperature remains within these limits
- Storage temperature 0 to +70°C
- Vibration 100 to 1000Hz, all axes, 24hrs

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 2004/108/EC

Ordercodes

Description	Ordercode
EPL-310	O 030 095 015 000

High-Speed Data Logger HSL-500

The HSL-500 is a compact, self-contained data logger for applications in top-level motorsport. It includes many innovative features including advanced hardware acceleration of front-end signal processing functions including filtering and down-sampling.

The unit can acquire data from on-board interfaces at rates of up to 400 kilosamples per second, and from remote units via communications links. A high-performance on-board PowerPC microprocessor offering over 1000MIPS processing power hosts customer applications for real-time data analysis. Application code may be autocoded using our Graphical Development Environment (GDE) from Matlab/Simulink control modules. Data is logged to 2GB of on-board Flash memory and downloaded for analysis via a Gigabit Ethernet network connection.

For example system configurations please refer to our Units and Datalogging application notes.

Key Features

- 400KHz analogue sampling speed

In Detail

Application

- General purpose data logging
- Real time telemetry transmission via ARCNET connection to MES telemetry system

Electrical

- Supply voltage 8V to 16V DC with reverse polarity and transient over-voltage protection
- 2GB Flash memory for logging
- Hardware acceleration of front-end signal processing functions including filtering and down-sampling
- Customer application processing power >1000MIPS

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Other Features

- ATLASLite and System Monitor configuration software licences supplied with each unit

Connection Definition

- Two 64-way Deutsch AS Double Density connectors

Mechanical

- Case material aluminium alloy, hard-anodised black
- Weight 625g

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Maximum operating temperature 70°C
- Storage Temperature -10°C to 85°C
- Vibration isolation is recommended

Sensor Inputs

- 12 analogue inputs supporting sampling rates □400 kilosamples per second, 0-5V
- 36 analogue inputs supporting sampling rates □100 kilosamples per second, 0-5V (Eight can be hardware configured to Pt1000 inputs)
- One Lap trigger input
- Eight DHE speed inputs
- Timing synchronisation input/output
- Ignition switch input
- “Force Boot” analogue input, 1ksps, 0-5V
- “IP Address Select” analogue input, 1ksps, 0-5V

Outputs

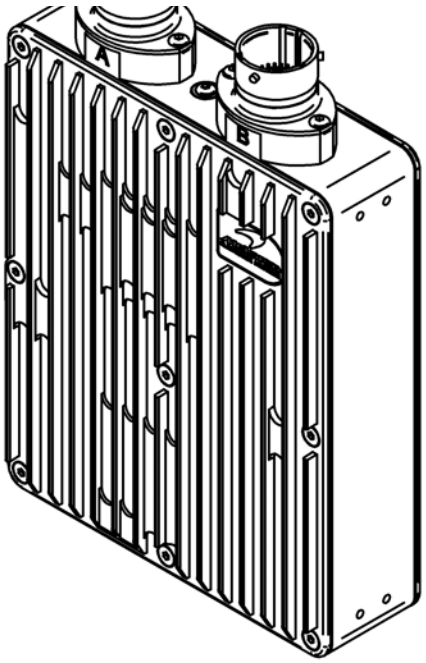
- Three sensor supplies at 5V, 100mA (one shared between both connectors)
- Five sensor supplies at 12V, 200mA
- One DHE sensor supply at 12V, 200mA
- One lap trigger supply at 5V, 200mA

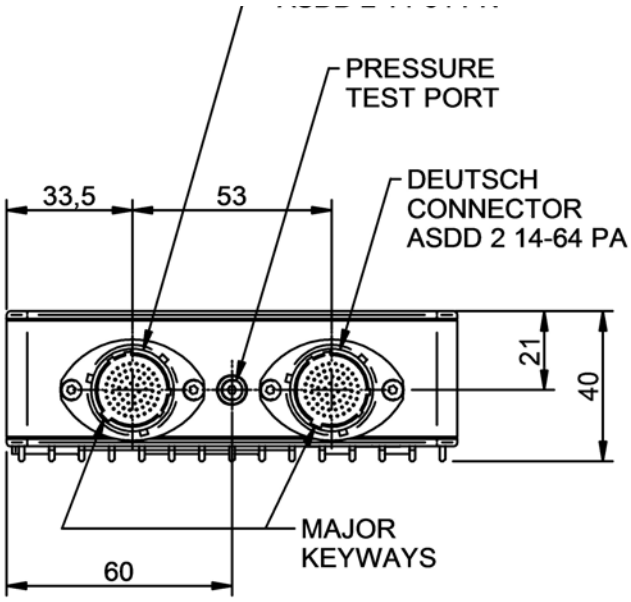
Communications

- One Gigabit Ethernet link (10/100/1000Mbps)
- One RS232 link (up to 1Mbps)
- One ARCNET link (10Mbps)
- Six CAN links (1Mbps) (One CAN can be replaced by 2nd FlexRay as a build option)

Images/Diagrams

O 030 095 012 000


A
B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TEST PORT
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CONNECTOR
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33,5
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MAJOR
KEYWAYS
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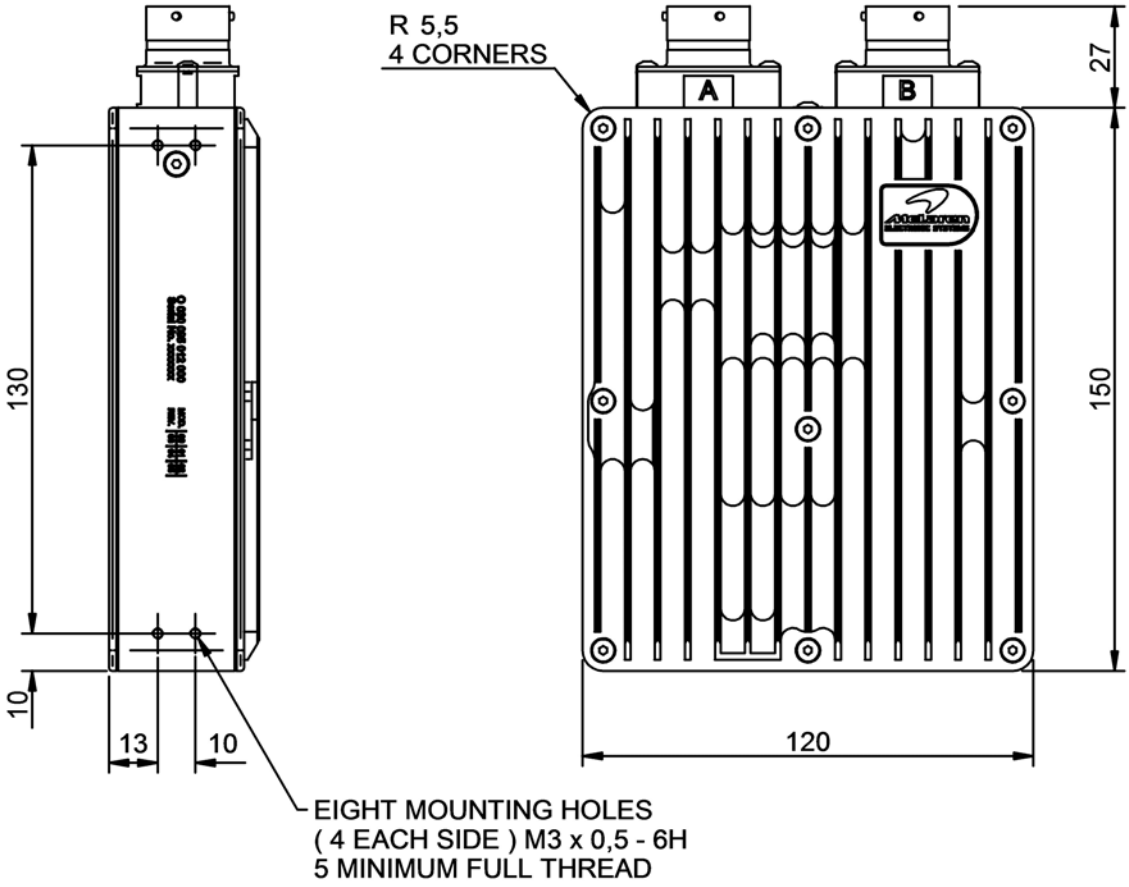
R 5,5
4 CORNERS
A
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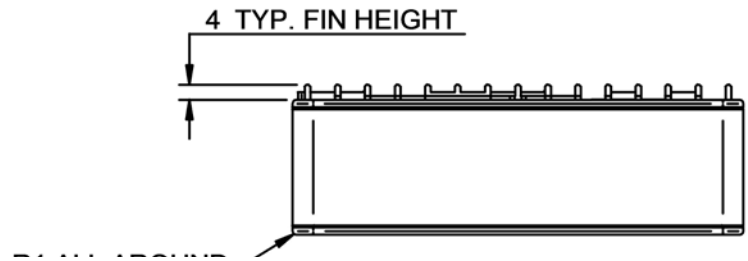
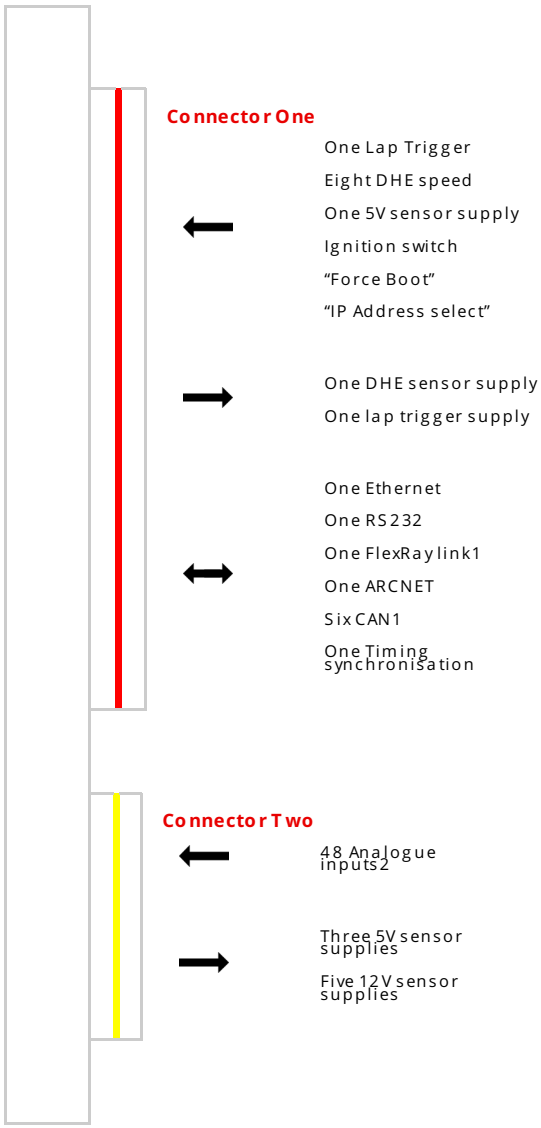
120
EIGHT MOUNTING HOLES
(4 EACH SIDE) M3 x 0,5 - 6H
5 MINIMUM FULL THREAD


4 TYP. FIN HEIGHT

R1 ALL AROUND

Connector Diagram

Connector Details



Ordercodes

Description	Ordercode
HSL-500 High Speed Logger (2GB memory, six CAN and one Flexray)	O 030 095 012 000

High-Speed Data Logger HSL-300

The HSL-300 sets the standard for self-contained data logging for applications in top-level motorsport. It includes many innovative features from the HSL-500 including advanced hardware acceleration of front-end signal processing functions and support for custom application code. An upgrade is also available to full HSL-500 functionality.

The unit can acquire data from on-board interfaces at rates of up to 10 kilosamples per second, and from remote units via communications links. A high-performance on-board PowerPC microprocessor offering over 1000MIPS processing power hosts customer applications for real-time data analysis. Application code may be autocoded using our Graphical Development Environment (GDE) from Matlab/Simulink control modules. Data is logged to 2GB of on-board Flash memory and downloaded for analysis via a Gigabit Ethernet network connection.

For example system configurations please refer to our Units and Datalogging application notes.

In Detail

Application

- General purpose data logging
- Real time telemetry transmission via ARCNET connection to MES telemetry system

Electrical

- Supply voltage 8V to 16V DC with reverse polarity and transient over-voltage protection
- 2GB Flash memory for logging
- Hardware acceleration of front-end signal processing functions including filtering and down-sampling
- Customer application processing power >1000MIPS

Electro Magnetic Compatibility

- Complies with the essential protection requirements of 89/336/EEC

Other Features

- ATLASLite and System Monitor configuration software licences supplied with each unit

Connection Definition

- Two 64-way Deutsch AS Double Density connectors

Mechanical

- Case material aluminium alloy, hard-anodised black
- Weight 625g

Environmental

- Splash resistant to standard motorsport fluids
- Lids sealed with o-rings
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Maximum operating temperature 70°C
- Storage Temperature -10°C to 85°C
- Vibration isolation is recommended

Sensor Inputs

- Eight analogue inputs supporting sampling rates 10 kilosamples per second, 0-5V
- 40 analogue inputs supporting sampling rates 1 kilosamples per second, 0-5V (Eight can be hardware configured to Pt1000 inputs)
- One Lap trigger input
- Eight DHE speed inputs
- Timing synchronisation input/output
- Ignition switch input
- “Force Boot” analogue input, 1ksps, 0-5V
- “IP Address Select” analogue input, 1ksps, 0-5V

Outputs

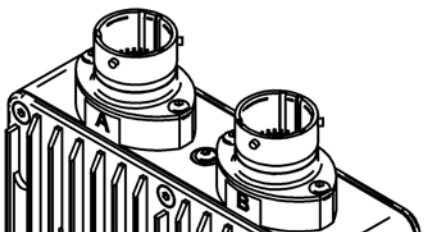
- Three sensor supplies at 5V, 100mA (one shared between both connectors)
- Five sensor supplies at 12V, 200mA
- One DHE sensor supply at 12V, 200mA
- One lap trigger supply at 5V, 200mA

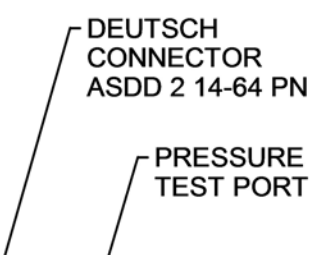
Communications

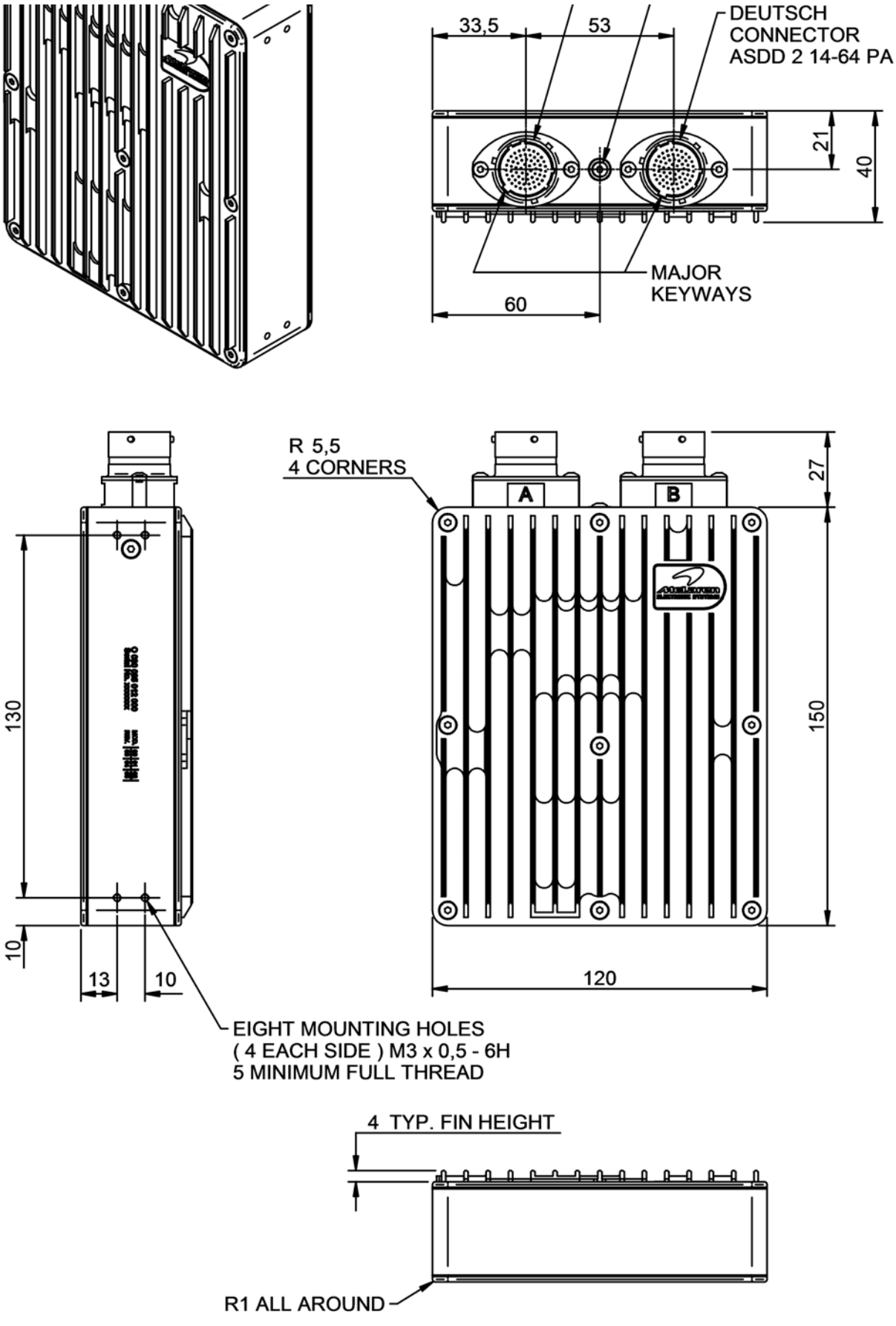
- One Gigabit Ethernet link (10/100/1000Mbps)
- One RS232 link (up to 1Mbps)
- One ARCNET link (10Mbps)
- Four CAN links (1Mbps)

Images/Diagrams

O 030 095 012 004

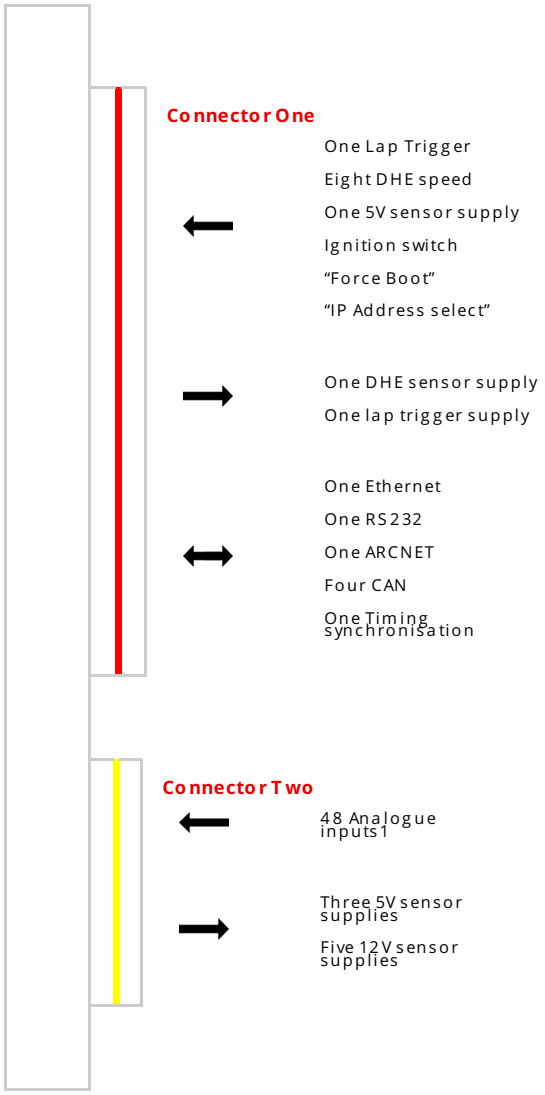






Connector Diagram

Connector Details



Ordercodes

Description	Ordercode
HSL-300 High Speed Logger	O 030 095 012 004
Upgrade from HSL-300 to HSL-500	O 030 095 012 005

Rainlight

RAINLIGHT 2 HIGH INTENSITY LED

The Rainlight 2 is a high-intensity LED based light with CAN connectivity for use at the rear of an F1 car.

The light is activated via a control signal input. Flashing speed and intensity are adjustable and diagnostic information is available via the CAN bus.

Default mode (without CAN link): the light flashes at 4Hz when the rainlight input is switched to supply voltage. The bright period intensity will be at 60% and the dim period intensity will be at 5%.

Red-orange and green versions are available.

In Detail

Electrical

- Supply 10V to 16V dc
- Supply not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Current up to 3.0A at 13.8V
- Rainlight input 5V to 16V dc
- Default rainlight flash rate 4Hz, 30% duty cycle
- Default bright period intensity 60%, dim period intensity 5%
- Internal temperature sensor
- 1 Mbps CAN bus for control and diagnostics (a termination resistor is NOT fitted within the unit)

Optical

Measurements at 25°C ambient after 30 minutes warm-up in ambient light of 14 lux. Unit temperature was indicated to be approx 58°C during the measurements.

Connection Definition

- Connector ASL006-05PN-HE
- Connection
-

Pin 1	Supply
Pin 2	Ground
Pin 3	Rainlight Input

Pin 4	CAN+
Pin 5	CAN-

Mechanical

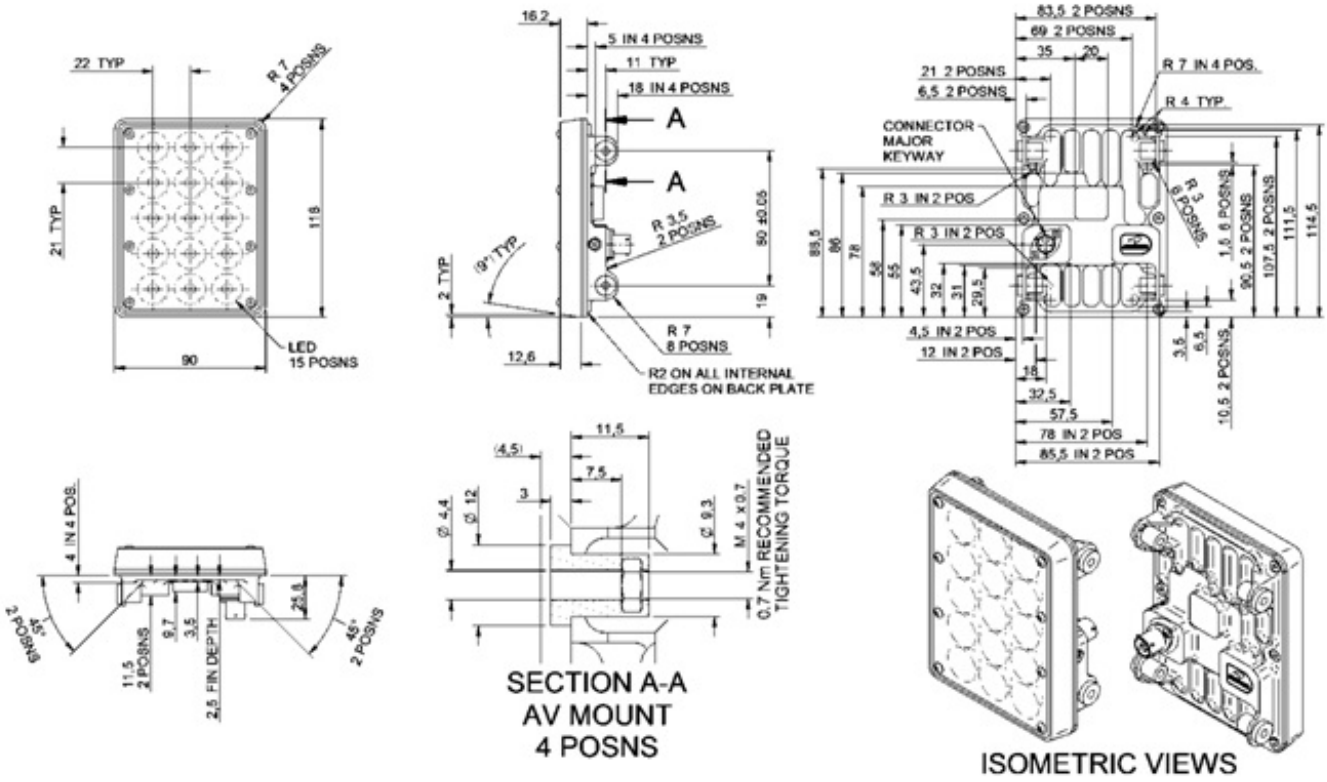
- Aluminium alloy body, hard anodised and dyed black
- Clear polycarbonate lens cover
- Black polyester surround
- Supplied with Q4 Flex-Loc A/V mounts
- Weight <265g

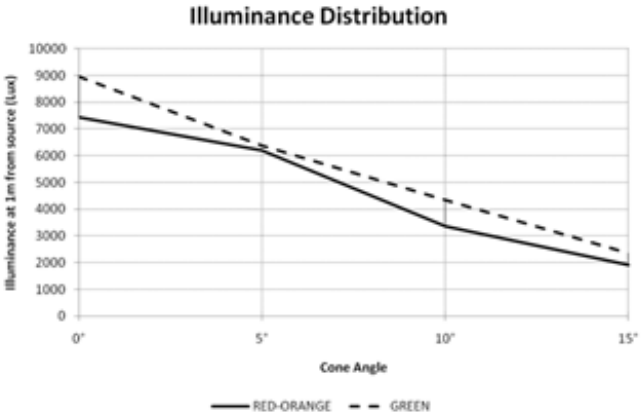
Environmental

- Splash resistant to standard Motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +85°C (as measured by the unit's internal temperature sensor)
- Storage temperature -10°C to +85°C
- Shock tested to 50g, 11ms
- Vibration 100 to 1000Hz, 24 hours each axis
-

100Hz	0.00797g
200Hz	0.17157g
300Hz	0.54279g
650Hz	0.00965g
1000Hz	0.02080g

Images/Diagrams





Ordercodes

Description	Ordercode
Rainlight CAN (Red LEDs)	O 030 970 010 009
Rainlight CAN (Green LEDs)	O 030 970 010 010

RAINLIGHT 3 HIGH INTENSITY LED

The Rainlight 3 is a high intensity LED based light with CAN connectivity for motorsport applications.

The light is activated via a control signal input. Flashing speed and intensity are adjustable and diagnostic information is available via the CAN bus. Default mode (without CAN link): The light flashes at 4Hz when the Rain Light input is switched to supply voltage. The bright period intensity will be at 90% and the dim period intensity will be at 5%. CAN base ID and other parameters are configurable.

In Detail

Electrical

- Supply 10V to 16V dc
- Supply not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Current up to 1.8A (red) and 2.4A (green) at 13.8V
- Typical current is 520mA at 13.8V (red)
- Rain light input 5V to 16V dc
- Default Rain light flash rate 4Hz, 40% duty cycle
- Default bright period intensity 90%, dim period intensity 5%
- Internal temperature sensor
- 1 Mbps CAN bus for control, diagnostics and configuration (a termination resistor is NOT fitted within the unit)

Optical

- LED colour Red-Orange (617nm wavelength) or Green (530nm wavelength)
- Typical maximum light intensity distribution as shown on graph
- CAN control of brightness and flash rate

Connection Definition

- Connector ASL006-05PN-HE
- Connection

Pin 1	Supply
Pin 2	Ground
Pin 3	Rain Light Input

Pin 4	CAN+
Pin 5	CAN-

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Clear polycarbonate lens cover
- Black polyester surround
- Supplied with Q4 Flex-Loc A/V mounts
- Weight < 260g

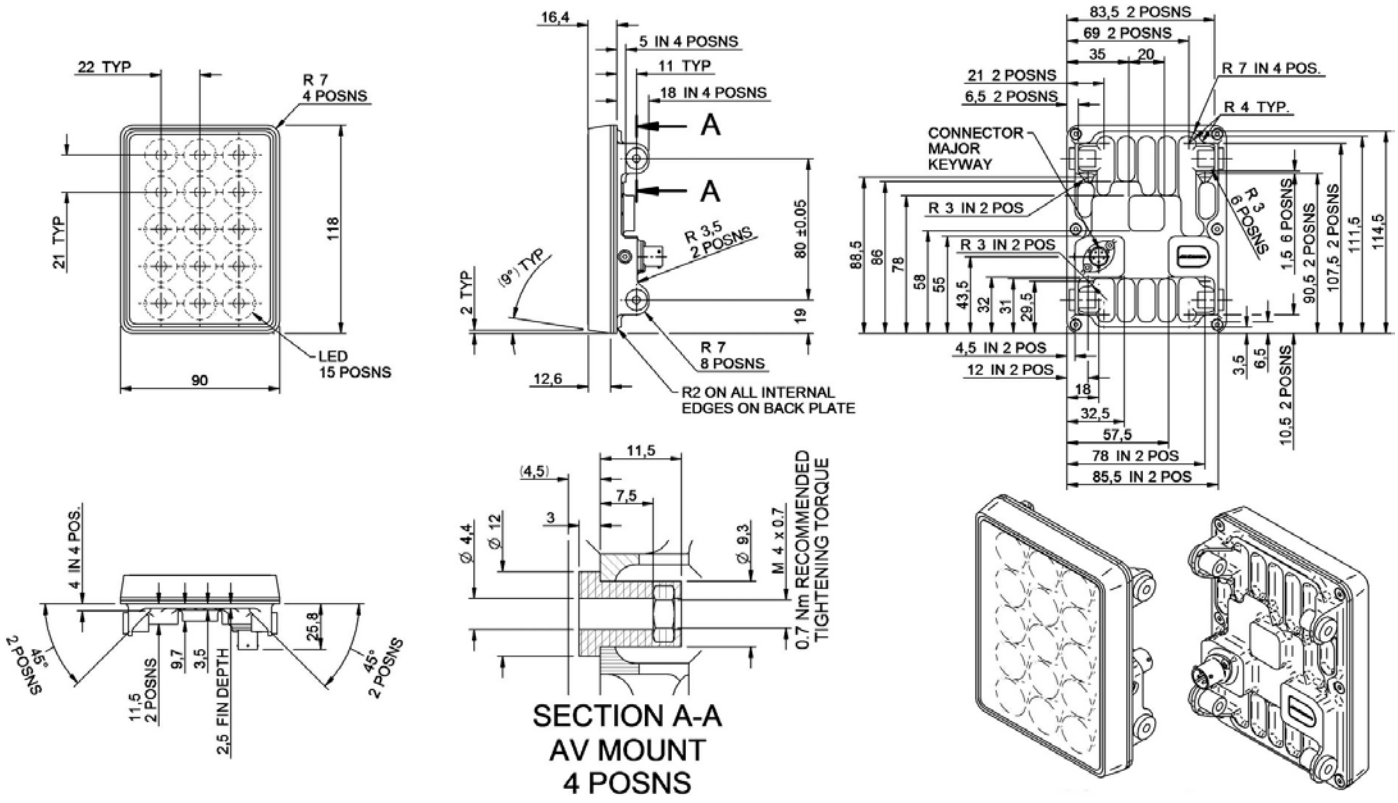
Environmental

- Splash resistant to standard Motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +85°C (as measured by the unit's internal temperature sensor)
- Storage temperature -10°C to +85°C
- Shock tested to 50g, 11ms
- Vibration 100 to 1000Hz, 24 hours each axis

100Hz	0.00797g^2/Hz
200Hz	0.17157g^2/Hz
300Hz	0.54279g^2/Hz
650Hz	0.00965g^2/Hz
1000Hz	0.02080g^2/Hz

Images/Diagrams

Rainlight 3



Ordercodes

Description	Ordercode
Rainlight 3 - RED LEDS	O 030 970 010 013
Rainlight 3 - GREEN LEDS	O 030 970 010 014

Sensors

Fluid Levels

Fluid Level Sensor All medium

The output of the fluid level sensor is a voltage which changes in direct proportion to the level of fluid in the probe. The difference in permittivity between air and the fluid being measured changes the capacitance between the probe's two concentric tubes as the level changes. An RS232 connection to a PC allows the user to calibrate the fluid level and thermal drift compensation. The probe is factory replaceable, allowing the electronics to be re-used should the probe become damaged or if a new probe length is required.

In Detail

Electrical

- Supply voltage 8 to 16Vdc
- Supply current 30mA max
- Supply reverse polarity protection
    - 0.25 ±0.05V empty
    - 4.75 ±0.05V full
- Output clamped between 0.1 ±0.05V and 4.9 ±0.05V
- Error condition output 4.95 to 5V
- Output resolution >11-bit
- Output update rate 200Hz
- Independent non-linearity 2%FSO
- Two point level calibration (empty and full) via PC software
- Three point thermal drift compensation (two linear ranges) via PC software

Connection Definition

- 26AWG un-screened cable
- Cable length 1000mm
- Connection
-

Red wire	Supply
White wire	Signal

Green wire	Ground
Yellow wire	Tx sensor (used for probe calibration only)
Blue wire	Rx sensor (used for probe calibration only)

Mechanical

- 78g for 100mm measurement range
- 126g for 300mm measurement range

- Aluminium alloy sensing head, hard anodised and dyed black
- Factory replaceable titanium alloy probe
- Fluid relative permittivity 1.5 to 3.5 (fuel & oil are typically about 2.2)

Environmental

- Maximum humidity 100%
- Viton jacketed cable
- Operating temperature 0 to 150°C
- Vibration 5 to 2000Hz @ 5g, 24 hours per axis
- Shock 50g, ½ sine for 11ms, five times in each axis

Software

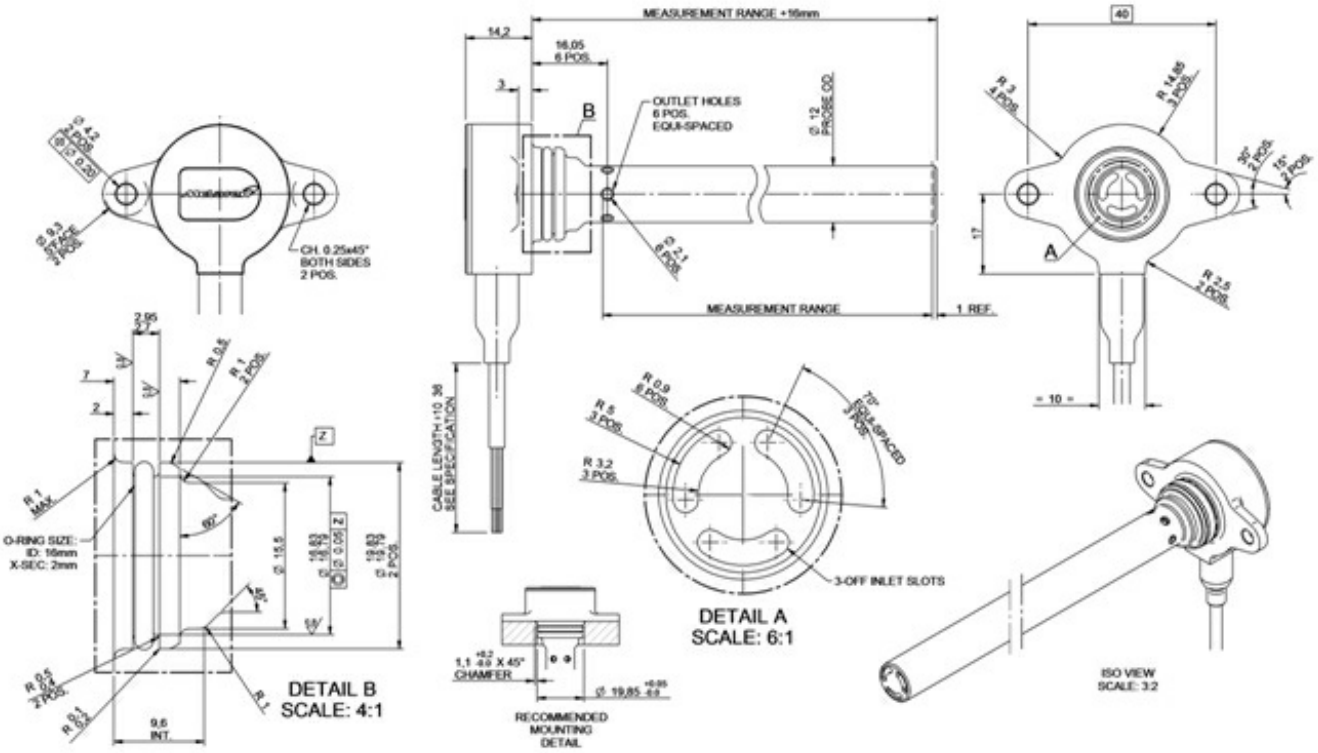
Note: Calibration lead O 030 380 990 000 can be ordered separately.

Design and manufacture is in-house so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable lengths, or measurement range. Please contact our technical consultancy service who will be pleased to help.

Images/Diagrams

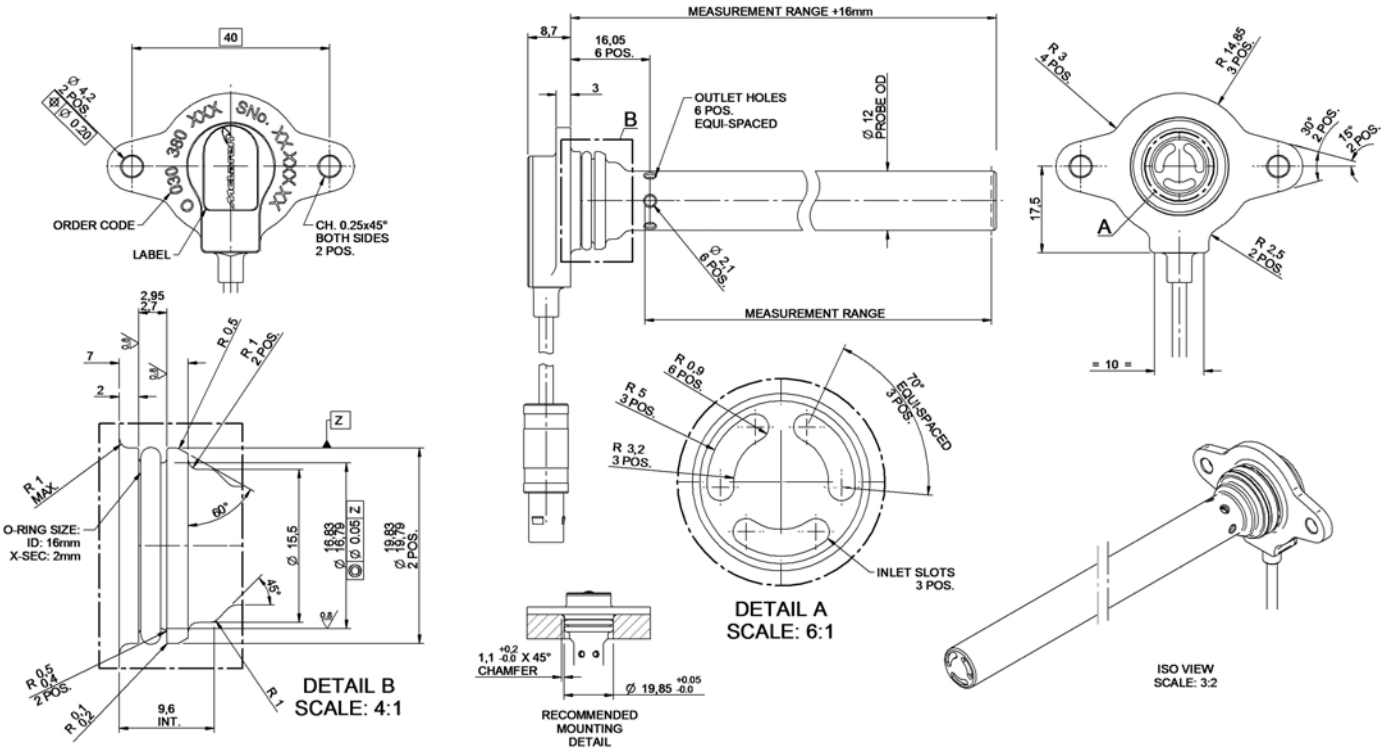
O 030 380 001 XXX

Integrated Electronics



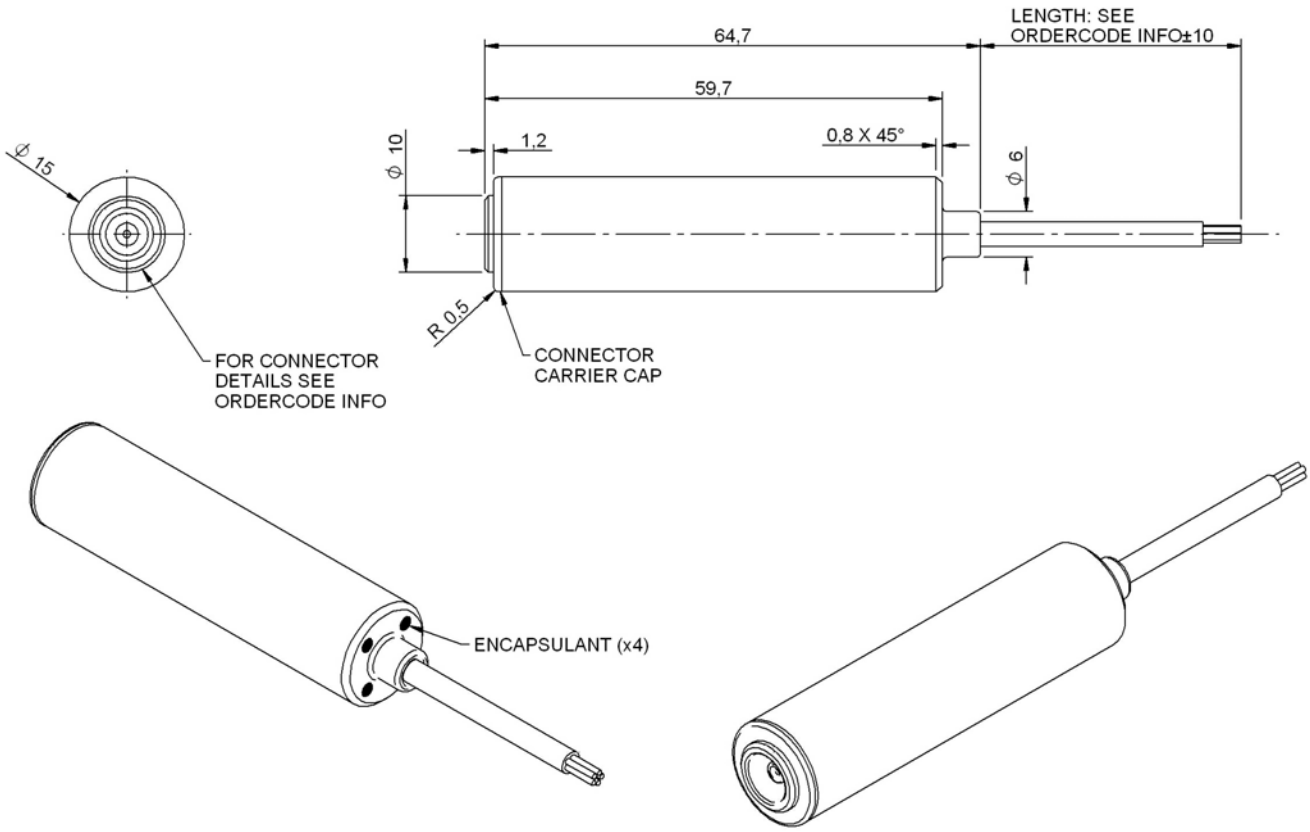
O 030 380 001 xxx

Remote Electronics- probe



O 030 380 001 012

Remote electronics



Ordercodes

Description	Ordercode
Integrated electronics	O 030 380 001 007
Remote Electronics	O 030 380 001 012
Remote Electronics - Probe	O 030 380 001 016

G-Sensors

Accelerometer 1 Axis

The unit is based on micro machined MEMS technology. The unit contains a ±35g sensing element. The element is scaled to optimise the resolution to suit the g range of interest. An internal amplifier provides an output between 0 and 5 volts. The on board microcontroller and temperature sensor are used for offset drift compensation. This unit can be re-calibrated at the factory.

For higher g applications a ±50g sensing element can be fitted and scaled to optimise the resolution.

In Detail

Electrical

- Supply Voltage 8 to 16V unregulated
- Range ±20g
- Output voltage at 25°C

0.5 ±0.10V	Full scale negative
2.5 ±0.05V	0g
4.5 ±0.10V	Full scale positive

- Sensitivity 100mV/g ± 2.5% max at 25°C
- Cross axis sensitivity ±3.5%
- Thermal sensitivity drift

+0.003 to +0.006%/°C over -20°C to 25°C

-0.007 to -0.017%/°C over 25°C to +105°C

-0.004 to -0.025%/°C over 105°C to +125°C

- Zero g drift ±0.2g max over operating temperature range
- Frequency response

-3dB at 60±5Hz, 2 pole filter

- Output impedance 50Ω
- Current Consumption <10mA

Cable and Connection Definition

- 24AWG un-screened cable
- Cable length 1000mm
- Connection

Red wire	Supply
Green wire	Ground
White wire	Signal

Mechanical

- Weight less than 65g (including cable)
- Polyester cable boss for strain relief to the sensor body
- Over range 500g (any axis powered for 0.5ms)

Environmental

- 6AL4V Titanium body and lid
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +125°C
- Viton jacketed cable

Ordercodes

Description	Ordercode
	O 030 345 006 015

Accelerometer 3 Axis

Accelerometers are available to measure up to three axes in a single, robust package. The sensing element is a micro-machined MEMS device. An internal amplifier provides an output between 0 and 5 volts. The unit can be offered in ranges up to ±50g. The -3dB point can also be configured to suit the application

In Detail

Electrical

- Supply Voltage 8 to 16V unregulated
- Range ±6g
- Output voltage (per axis)
- 0.5 ±0.075V Full scale negative
- 2.5 ±0.05V 0g
- 4.5 ±0.075V Full scale positive
- Sensitivity 333.3mV/g ±2.5% max at 25°C
- Thermal sensitivity drift
- +0.003 to +0.006%/°C over -20°C to 25°C
- -0.007 to -0.017%/°C over 25°C to +85°C
- Max zero g drift over operating temperature range
- ±0.1g for g range of less than or equal to ±10g
- ±0.25g for g range of less than or equal to ±35g
- ±0.40g for g range of less than or equal to ±50g
- Frequency response
- -3dB at 60±5Hz over operating temperature range 8 pole Butterworth filter
- Cross axis sensitivity ±3.5%
- Output impedance 50□
- Current Consumption <30mA

Mechanical

- Weight less than 80g (including cable)
- Polyester cable boss for strain relief to the sensor body

- Over range 4000g (any axis)

Cable and Connection Definition

- 26AWG un-screened cable
- Connection
-

Red wire	Supply
Green wire	Ground
White wire	X axis signal
Yellow wire	Y axis signal
Blue wire	Z axis signal

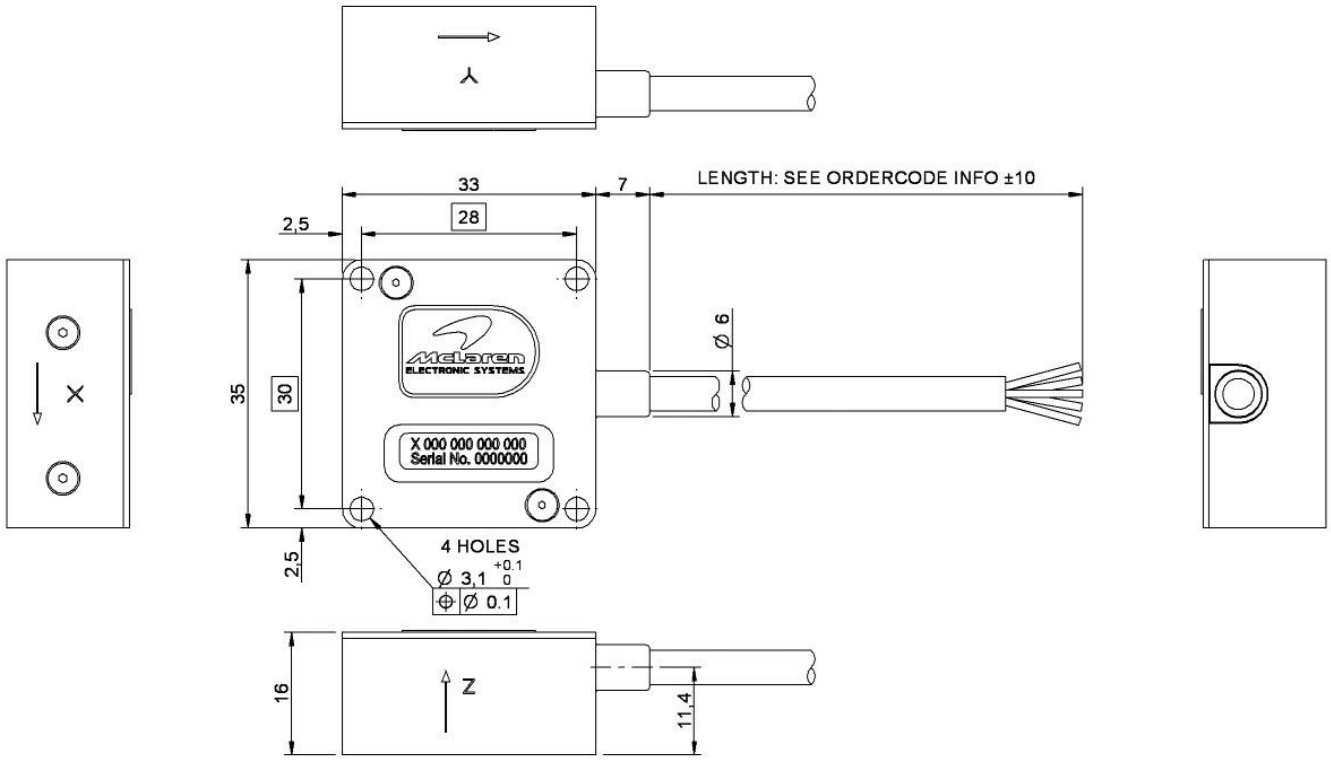
- Various automotive and military standard connectors are available
- Cable length is shown on the order details but any length is available upon request

Environmental

- Aluminium body, hard anodised and dyed black
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -40 to +85°C
- Viton jacketed cable

Images/Diagrams

3 Axis Accelerometer



Ordercodes

Description	Ordercode
6G Range	O 030 345 007 028
10G Range	O 030 345 007 029
35G Range	O 030 345 007 033

Accelerometer 2 Axis

Accelerometers are available to measure up to three axes in a single, robust package. The sensing element is a micro-machined MEMS device. An internal amplifier provides an output between 0 and 5 volts. The unit contains a ±35g sensing element which is scaled to ±5g. This element can be replaced with a ±10g sensing element scaled to suit the g range of interest and application.

In Detail

Application

Precision chassis development, circuit mapping.

Electrical

0

Cable and Connection Definition

- 24AWG un-screened cable
- Connection
-

Red wire	Supply
Green wire	Ground
White wire	X axis signal
Yellow wire	Y axis signal

- Various automotive and military standard connectors are available
- Cable length is shown on the order details but any length is available upon request

Mechanical

- Weight less than 50g (including cable)
- Polyester cable boss for strain relief to the sensor body
- Over range 500g (any axis powered for 0.5ms)

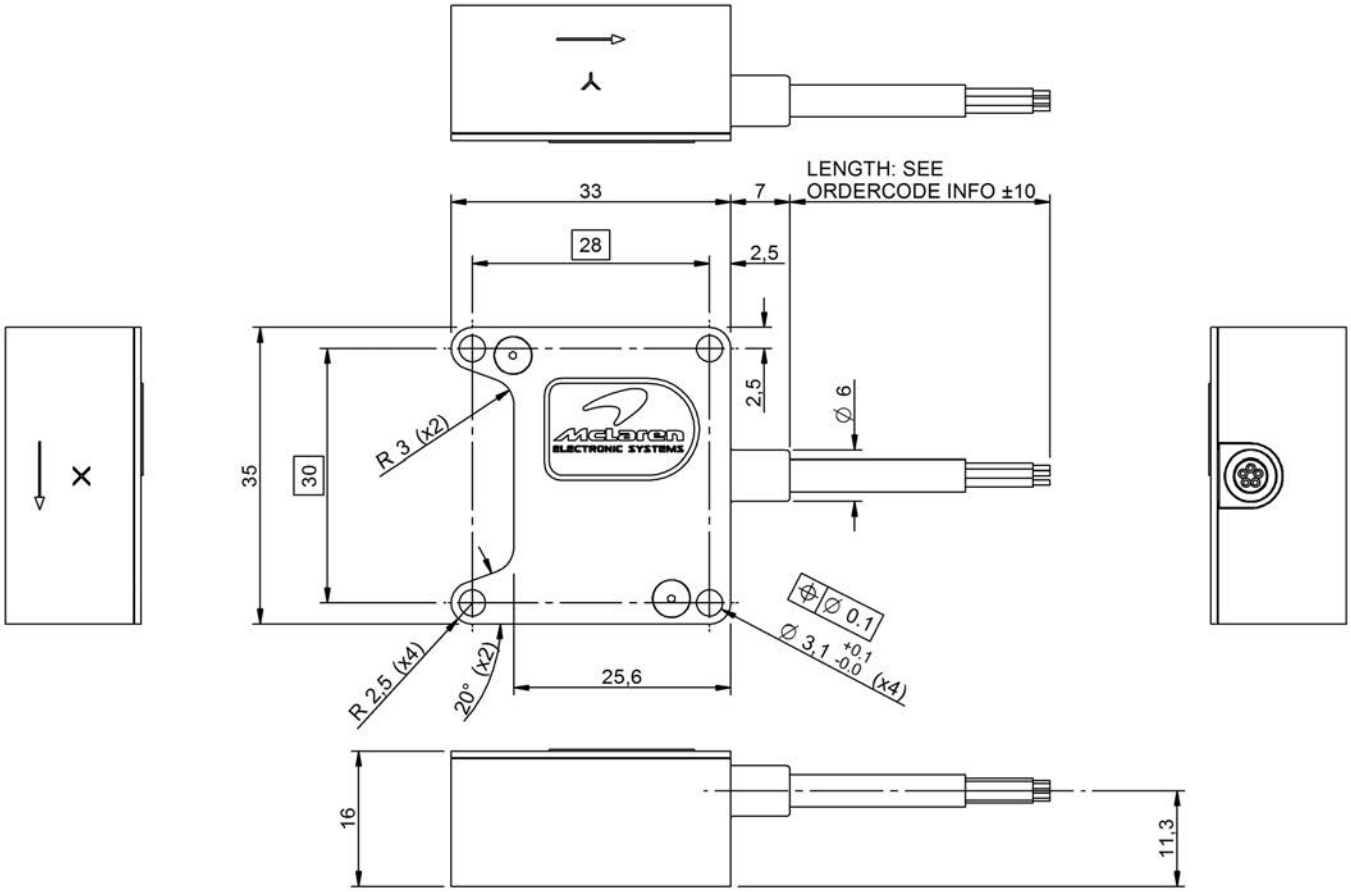
Environmental

- Aluminium body, hard anodised and dyed black
- Resistant to standard motorsport fluids

- Maximum humidity 100%
- Operating temperature 0 to +85°C
- DR25 jacketed cable

Images/Diagrams

2Axis Accelerometer



Ordercodes

Description	Ordercode
±6g/±6g	O 030 345 005 016
±10g/±10g	O 030 345 005 017

Accelerometer Interface Unit AIU-6

Available with two, three or six channels, the AIU (Accelerometer Interface Unit) is to be used with IEPE (Integrated Electronics Piezo-Electric) accelerometers and harness to provide a high-frequency/high-G signal for the High Speed Logger (HSL-500) or alternative unit.

The AIU provides a constant current source to power the IEPE accelerometer. The voltage output from the IEPE is attenuated and buffered by the AIU to convert the 10V full scale measurement range to an output in the range of 0.5 to 4.5V, biased at 2.5V.

In Detail

AIU - Application

High-frequency chassis and engine vibration analysis.

AIU - Electrical

- Supply Voltage 8 to 16V
- Reverse polarity protection
- Excitation voltage 24±0.2V
- Excitation current 2.45±0.1mA per channel
- Output voltage per channel

0.5 ±0.025V	Full scale negative
2.5 ±0.025V	0g
4.5 ±0.025V	Full scale positive

- The above tolerance does not include the sensitivity tolerance and sensitivity drift of the IEPE accelerometer
- Gain fixed at 0.4
- AC coupled
- Filter characteristics:
    - High pass Filter: -3dB at 10Hz
    - Low pass Filter: -3dB at 4.8kHz
    - Output impedance 100

AIU - Environmental

- HE30 aluminium alloy body, anodised and dyed blue
- Splash resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +125°C

Six-Channel AIU - Electrical

- Supply current 60mA @ 12V typ

Six-Channel AIU - Mechanical

- Weight less than 45g

Six-Channel AIU - Cable and Connection Definition

- Output connector: Lemo HES.1F.308.XLDP

Pin 1	Supply
Pin 2	Ground
Pin 3	Output Channel 1
Pin 4	Output Channel 2
Pin 5	Output Channel 3
Pin 6	Output Channel 4
Pin 7	Output Channel 5
Pin 8	Output Channel 6

- Input Connector: Lemo HEN.1F.308.XLNP

Pin 1	Excitation Ground
Pin 2	Excitation Ground
Pin 3	IEPE Channel 1
Pin 4	IEPE Channel 2
Pin 5	IEPE Channel 3
Pin 6	IEPE Channel 4
Pin 7	IEPE Channel 5
Pin 8	IEPE Channel 6

Three-Channel AIU - Electrical

- Supply current 37mA @ 12V typ

Three-Channel AIU - Mechanical

- Weight less than 35g

Three-Channel AIU - Cable and Connection Definition

- Output connector: Lemo HES.0F.305.XLDP

Pin 1	Supply
Pin 2	Ground
Pin 3	Output Channel 1
Pin 4	Output Channel 2
Pin 5	Output Channel 3

- Input Connector: Lemo HES.0F.305.XLNP

Pin 1	Excitation Ground
Pin 2	Excitation Ground
Pin 3	IEPE Channel 1
Pin 4	IEPE Channel 2
Pin 5	IEPE Channel 3

Two-Channel AIU - Electrical

- Supply current 29mA @ 12V typ

Two-Channel AIU - Mechanical

- Weight less than 30g

Two-Channel AIU - Cable and Connection Definition

- Output connector: Lemo HES.FF.304.XLDP

Pin 1	Supply
Pin 2	Ground
Pin 3	Output Channel 1
Pin 4	Output Channel 2

- Input Connector: Lemo HEN.FF.304.XLNP

Pin 1	Excitation Ground
Pin 2	Excitation Ground
Pin 3	IEPE Channel 1
Pin 4	IEPE Channel 2

IEPE Three-Axis - Electrical

- Excitation voltage 18 to 30 VDC
- Constant current excitation 2 to 20mA
- Output impedance 200ohm
- Output Bias voltage 7 to 11 VDC

- Settling time (within 10% of bias) <3sec

IEPE Three-Axis - Performance

- Sensitivity: 5mV/g ±20%
- Measurement range: ±1000g
- Frequency range (±5%) Y and Z axis: 2 to 8000Hz
- Frequency range (±5%) X axis: 2 to 5000Hz
- Frequency range (+1dB) X axis: 5000 to 8000Hz
- Broadband resolution 1 to 10000Hz: 0.003g rms
- Non-linearity: □1%
- Transverse sensitivity: □5%

IEPE Three-Axis - Environmental

- Titanium body
- Operating temperature -50 to +180°C
- Overload limit (shock) ±10000g pk

IEPE Three-Axis - Mechanical

- Weight less than 1g (without cable)

IEPE Three-Axis - Cable and Connection Definition

- Cable length 1500mm

IEPE Three-Axis - Interface Harnesses

- Teflon coated cable
- Harness length 1000mm

IEPE One-Axis - Electrical

- Excitation voltage 18 to 30 VDC
- Constant current excitation 2 to 20mA
- Output impedance □200ohm
- Output Bias voltage 7 to 11 VDC
- Settling time (within 10% of bias) <3sec

IEPE One-Axis - Performance

- Sensitivity: 5mV/g ±20%
- Measurement range: ±1000g
- Frequency range (±5%): 2 to 10000Hz
- Frequency range (±10%) 1.5 to 15000Hz
- Frequency range (±3dB) 0.7 to 25000Hz
- Broadband resolution 1 to 10000Hz: 0.003g rms
- Non-linearity: □1%
- Transverse sensitivity: □5%

IEPE One-Axis - Environmental

- Aluminium body
- Operating temperature -50 to +120°C
- Overload limit (shock) ±10000g pk

IEPE One-Axis - Mechanical

- Weight 0.2g typical

IEPE One-Axis - Cable and Connection Definition

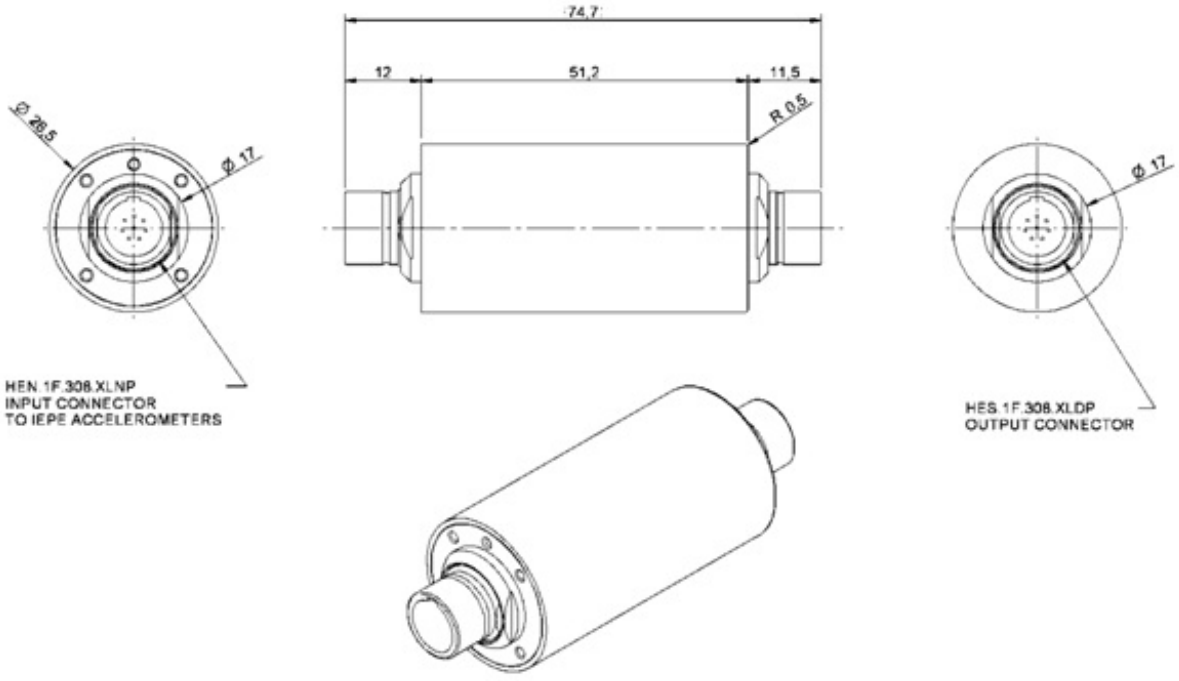
- 3-56 Coaxial Jack

IEPE One-Axis - Interface Harnesses

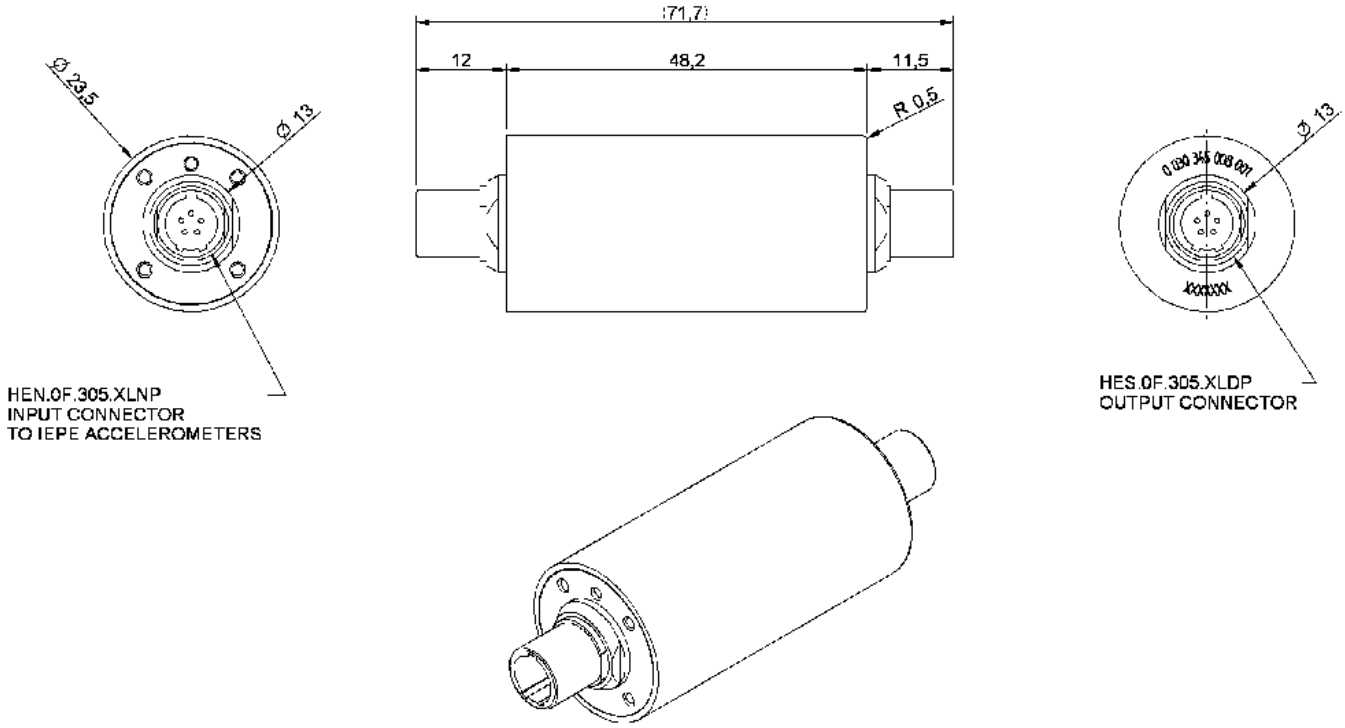
- Teflon-coated cable
- Harness length 1000mm

Images/Diagrams

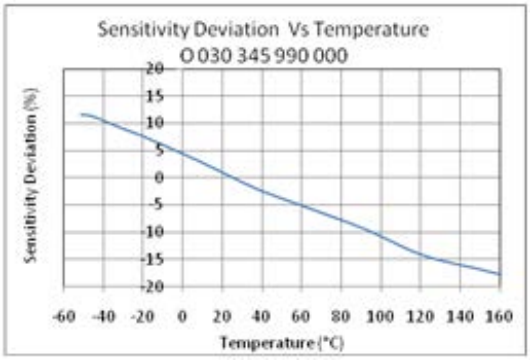
6-channel AIU



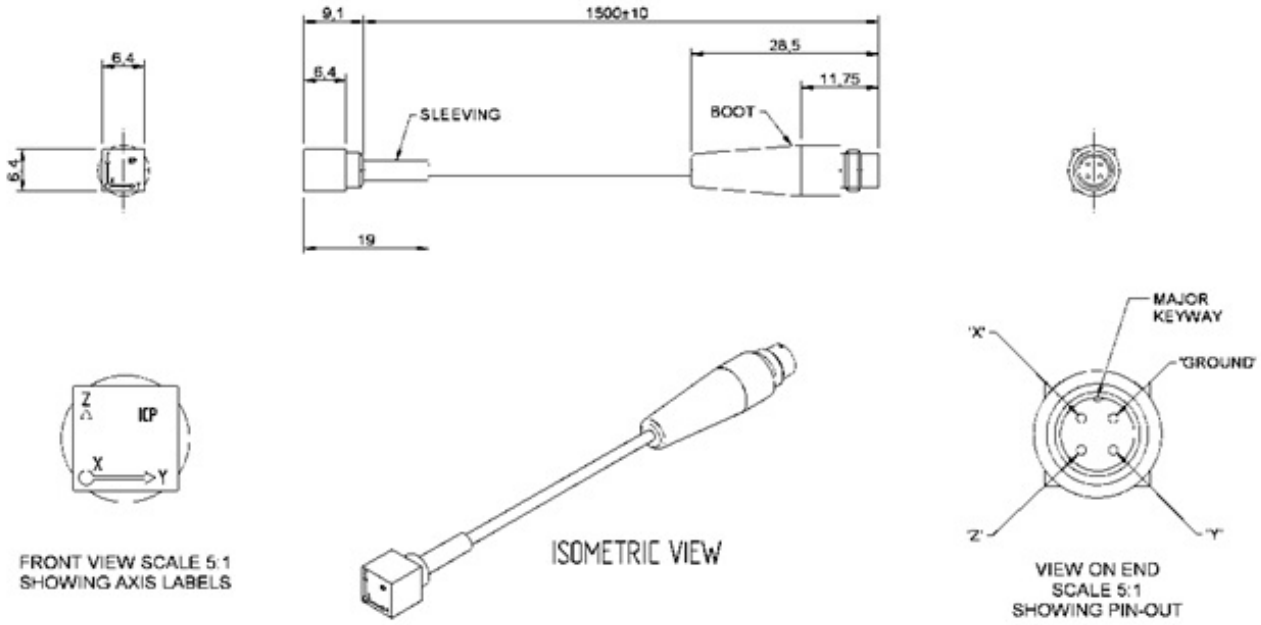
3-channel AIU



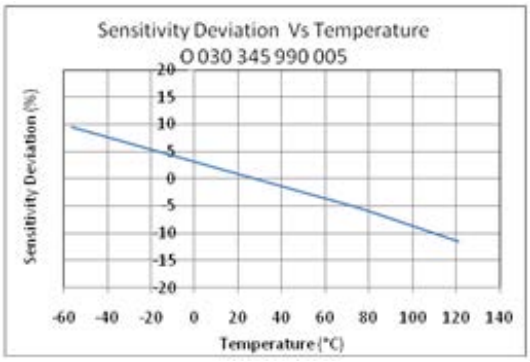
IEPE Three-Axis - Sensitivity Deviation vs. Temperature



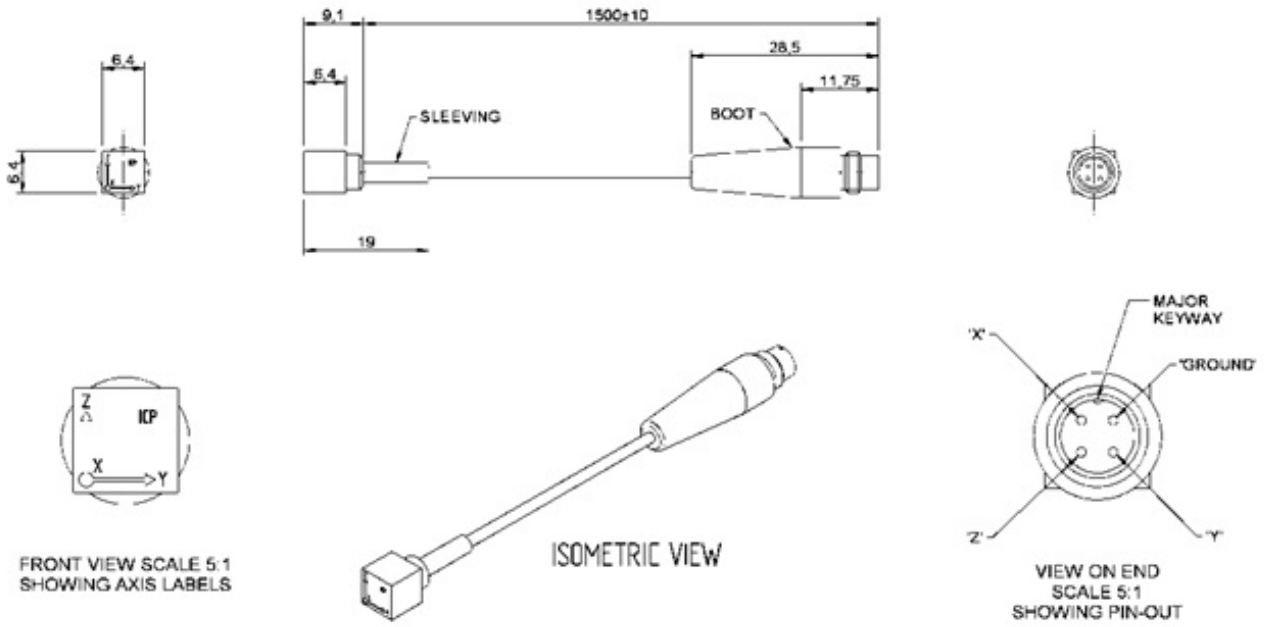
IEPE Three-Axis



IEPE One-Axis - Sensitivity Deviation vs. Temperature



IEPE One-Axis



Ordercodes

Description	Ordercode
Six-Channel AIU	O 030 345 008 000
Three-Channel AIU	O 030 345 008 001
Two-Channel AIU	O 030 345 008 002
±1000g three-axis accelerometer	O 030 345 990 000
±1000g one-axis accelerometer	O 030 345 990 005
AIU6 harness connects two, three-axis accelerometers	O 030 345 990 001
AIU6 harness connects six, one-axis accelerometers	O 030 345 990 002
AIU3 harness connects one, three-axis accelerometer	O 030 345 990 003
AIU2 harness connects two, one-axis accelerometers	O 030 345 990 004
AIU3 harness connects three, one-axis accelerometers	O 030 345 990 006

Accelerometer Interface Unit AIU-24

The AIU is to be used with IEPE (Integrated Electronics Piezo-Electric) accelerometers. The unit provides a stabilised supply for excitation. The gain for each channel is configurable via a software GUI to convert the 10V full scale measurement range from an IEPE accelerometer to an output in the range of 0.5 to 4.5V.

In Detail

Electrical

- Supply voltage 8 to 16 V DC
- Reverse polarity protection
- Supply current 315mA @12V typ
- Excitation Voltage 24±0.2V
- Excitation Current 4±0.1mA per channel
- Output voltage per channel

0.5V ± 0.025V	Full scale positive
2.5V ± 0.025V	0g
4.5V ± 0.025V	Full scale negative

The above tolerance does not include the sensitivity tolerance and sensitivity drift of the IEPE accelerometer

- AC coupled
- Filter Characteristics

High pass Filter: -3dB at 11Hz

Low Pass Filter: -3dB at 5.2kHz

- Output Impedance 100?
- The gain can be adjusted with a software tool, which is supplied with the unit

Cable and Connection Definition

- Output Connector (O/P Conn.):

  Lemo HES.3F.330.XLDP

PIN	DESCRIPTION
1	Supply
2	Supply Gnd
3	Signal Gnd
4	Output CH1
5	Output CH2
6	Output CH3
7	Output CH4
8	Output CH5
9	Output CH6
10	Output CH7
11	Output CH8
12	Output CH9
13	Output CH10
14	Output CH11
15	Output CH12
16	Output CH13
17	Output CH14
18	Output CH15
19	Output CH16
20	Output CH17
21	Output CH18
22	Output CH19
23	Output CH20
24	Output CH21
25	Output CH22
26	Output CH23
27	Output CH24
28	CAN +
29	CAN -
30	NC

- Input Connector (A):
  Lemo HEN.1F.308.XLNP
-

PIN	DECRIPTION
1	Excitation Gnd
2	Excitation Gnd
3	IEPE CH1
4	IEPE CH2
5	IEPE CH3
6	IEPE CH4
7	IEPE CH5
8	IEPE CH6

- Input Connector (C):
  Lemo HEN.1F.308.XLNP
-

PIN	DESCRIPTION
1	Excitation Gnd
2	Excitation Gnd
3	IEPE CH13
4	IEPE CH14
5	IEPE CH15
6	IEPE CH16
7	IEPE CH17
8	IEPE CH18

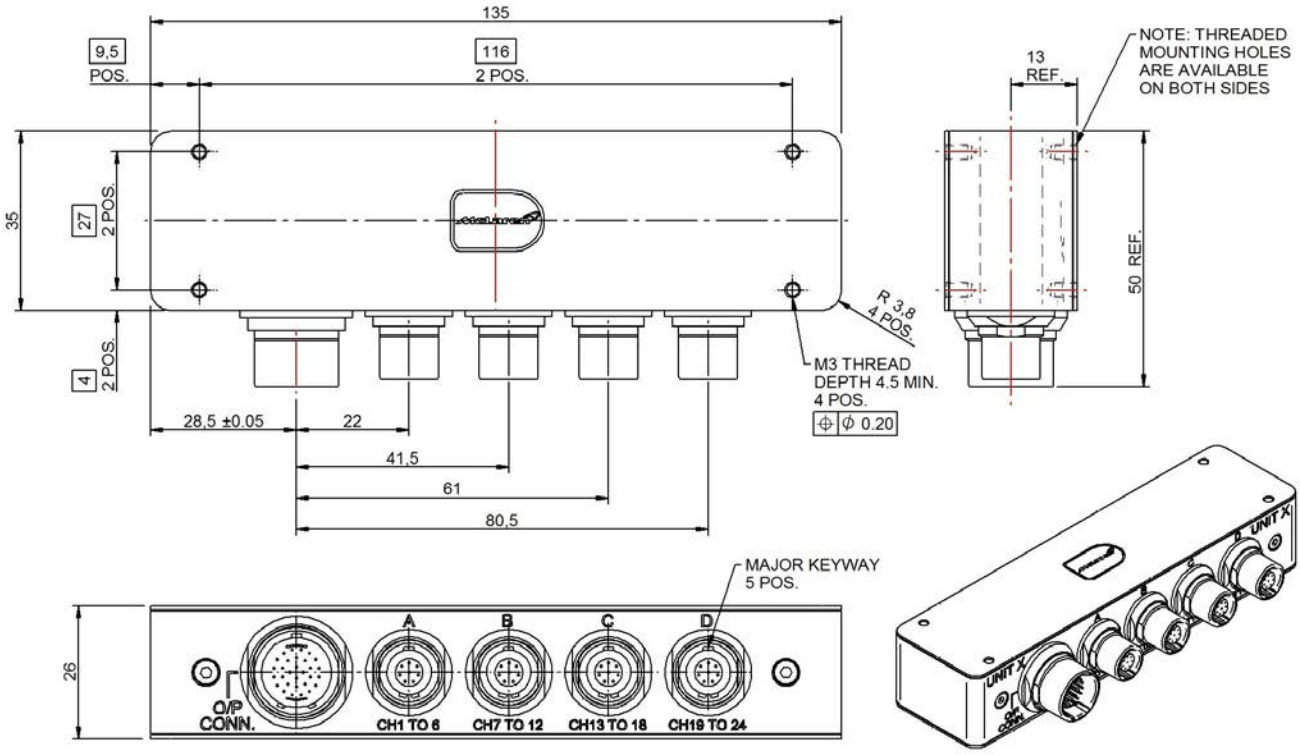
- Input Connector (D): Lemo HEN.1F.308.XLNP
-

PIN	DESCRIPTION
1	Excitation Gnd
2	Exictation Gnd
3	IEPE CH19
4	IEPE CH20
5	IEPE CH21
6	IEPE CH22

7	IEPE CH23
8	IEPE CH24

Images/Diagrams

AIU-24



Ordercodes

Description	Ordercode
AIU-24	O 030 345 008 003

Gyros

Gyro 3 Axis

Designed to provide high performance operation under harsh operating conditions, the tri-axis gyro accurately measures angular motion in a compact, lightweight, robust package.

In Detail

Application

- Precision chassis development.

Electrical

- Supply voltage 8 to 16V unregulated
- Reverse Polarity protection
- Supply current 140mA @ 12V
- Start-up supply current 225mA (0-500ms)
- Full scalerate ±300°/s[1] or ±75°/s[1]
- Output scale factor:
- *300°/s = 6.67mV/°/s nominal*
- *75°/s = 26.67mV/°/s nominal*
- Scale factor variation ±0.75%
- Scale factor variation over operating temperature range ±1.5%
- Scale factor rate non-linearity ±0.2% FS
- Offset at zero angular velocity 2.50V nominal
- Offset variation ±20mV (300°/s = ±3°/s & 75°/s = 0.75°/s)
- Offset variation over temperature range ±30mV (300°/s = ±4.5°/s & 75°/s = 1.1°/s)
- 8 pole 60Hz Butterworth filter[2/3]
- Noise <175 µV/√Hz
- Output impedance 50 Ohms
- PT1000 temperature output

Clockwise rotation about the axis identified in the drawing, will increase the output voltage, as shown in the outline

drawing.

[1] Combinations of both scale rates can be requested.

[2] Two pole filter available upon request[3].

[3] -3dB point adjustable up to 90Hz.

Cable and Connection Definition

- 26 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connections:

Red wire	Pin 1	Supply
White wire	Pin 2	Signal A
Yellow wire	Pin 3	Signal B
Orange wire	Pin 4	Signal C
Green wire	Pin 5	Power Ground
Blue wire	Pin 6	Signal Ground

Mechanical

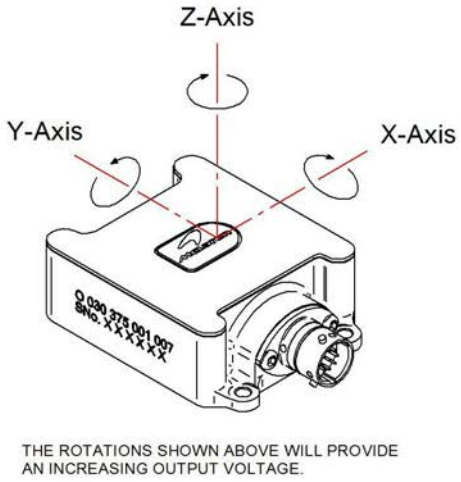
- Weight less than TBAg (including cable)

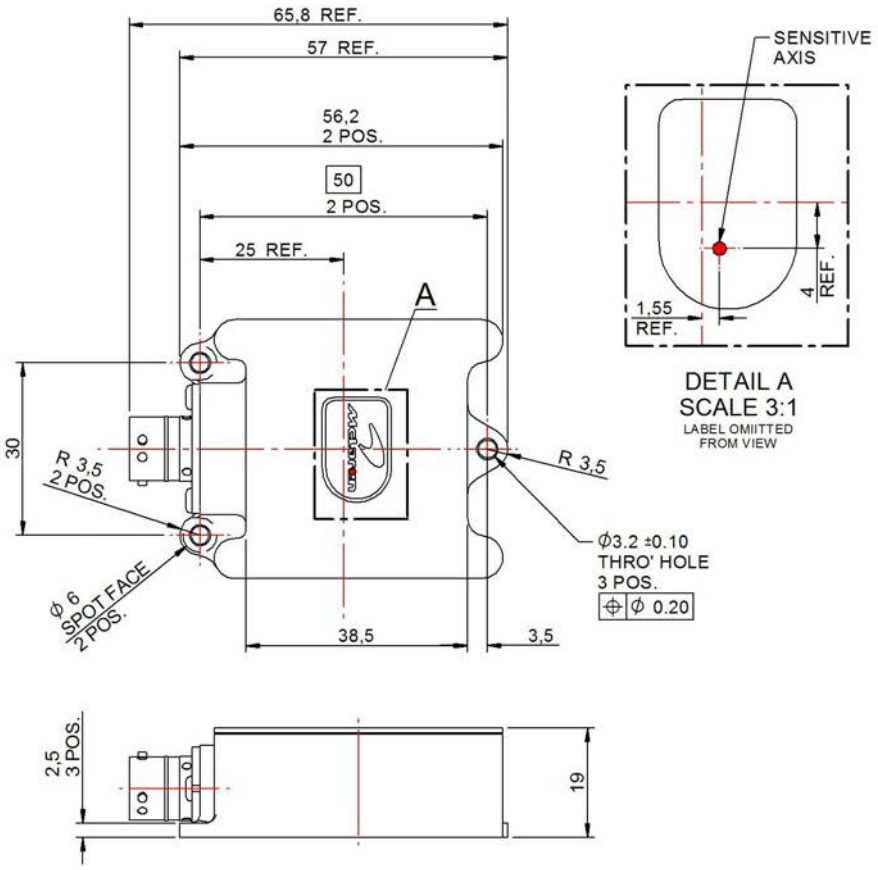
Environmental

- Vibration 20Hz to 2kHz @ 8.5g rms
- Shock ½ sine approx, 95g, 1ms
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +105°C
- Aluminium alloy body and lid, hard anodised and dyed black
- DR25 jacketed cable

Images/Diagrams

3 Axis Gyro





Ordercodes

Description	Ordercode
3-Axis Gyro (±300°/s)	O 030 375 001 007
3 Axis Gyro (±75°/s)	O 030 375 001 008

Gyro 1 Axis

Designed to provide high performance operation under harsh operating conditions, the single axis gyro accurately measures angular motion is a compact, lightweight, robust package.

In Detail

Application

Precision chassis development.

Cable and Connection Definition

- 26 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection
-

Red wire	Pin A	Pin 1	Supply
White wire	Pin B	Pin 2	Signal
Green wire	Pin C	Pin 3	Power Ground
Blue wire	Pin D	Pin 4	Signal Ground (optional)
Yellow wire	-	-	Filler (only if Signal Ground wire required)

Mechanical

- Weight less than TBAg (including cable)

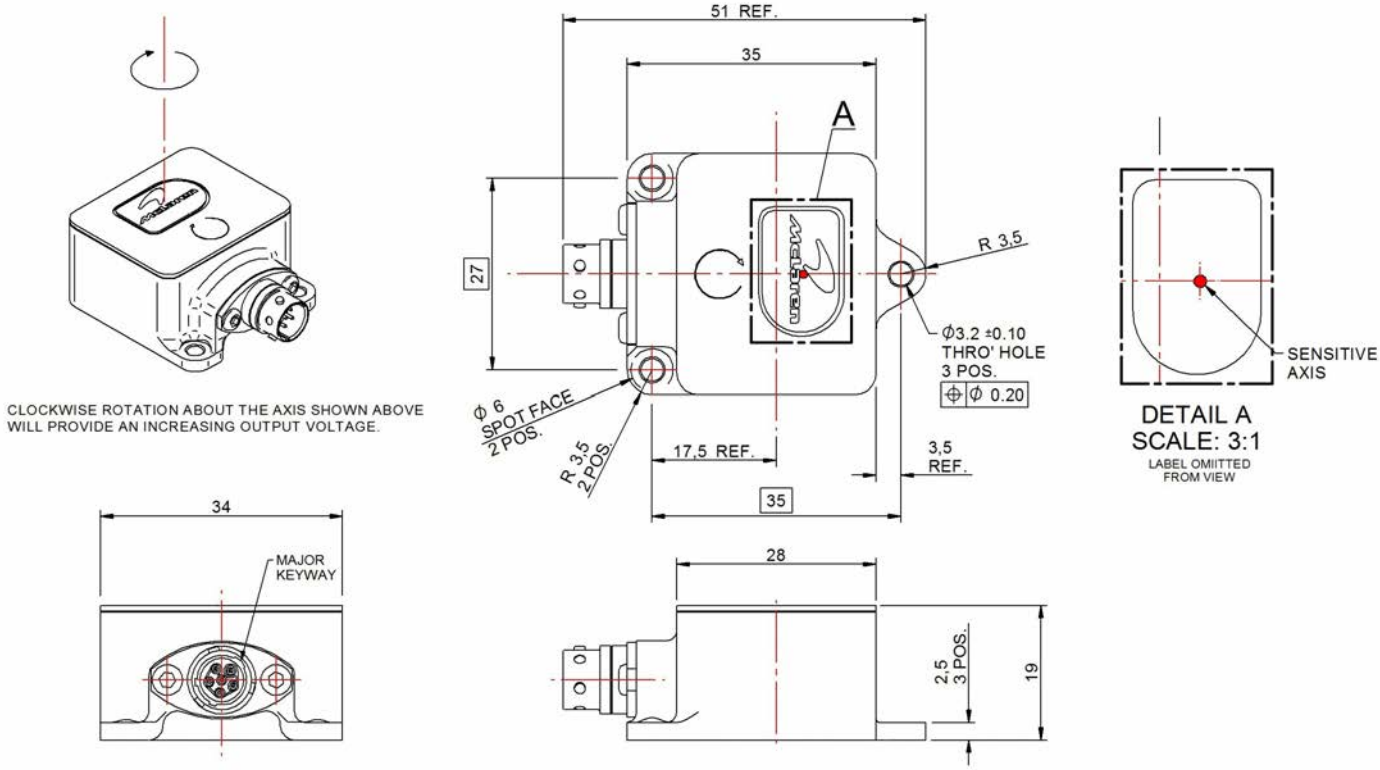
Environmental

- Vibration 20Hz to 2kHz @ 8.5g rms
- Shock ½ sine approx, 95g, 1ms
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +105°C
- Storage temperature -50 to +110°C
- Aluminium alloy body and lid, hard anodised and dyed black

- Viton jacketed cable

Images/Diagrams

O 030 375 000 016



Ordercodes

Description	Ordercode
	O 030 375 000 016

Infra-Red Temperature

Temperature Sensor 16 x 4 Infra-Red Array

The infrared sensor measures temperature at a distance without contacting the target. The integrated infrared module senses the thermal radiation emitted by objects on a 16 x 4 array of sensing points, for measuring the temperature distribution across a surface. These 64 measurement pixels are transmitted via CAN to the host controller or data logging device. The sensor is available in both 35° and 60° field of view options to suit a variety of installations. A software package is provided for viewing live temperature data from the array.

In Detail

Electrical

- Supply voltage 8V to 16V
- Supply current 150mA (max) @ 12V
- Response time after power up 50ms typ, 1s max
- Target temperature range 0 to +300°C
- Unit outputs over CAN: 64 temperature points, 1 ambient temperature, 1 unit power supply diagnostic

CAN Output

- ISO011898 1Mbit/s CAN communications link for configuration and data transmission
    - 14-bit – Transmits 17 messages per frame
    - 9-bit – Transmits 12 messages per frame
- Ambient temperature resolution: 12bit
- Unit supply diagnostic: 8bit
- CAN sampling rate configured by host ECU up to 20Hz
- CAN message identifiers configured by host ECU allowing multiple module sharing a common bus (a fixed CAN identifier will be required for configuration messages)
- The CAN bus link must be terminated using a 120 resistor. No internal CAN termination as standard
- The unit can be supplied with internal termination if required

Cable and Connection Definition

- 26AWG cable
- 1000mm cable length
    -

Red wire	Supply
Black wire	Ground
Blue wire	CAN +
White wire	CAN -

- Bespoke cable lengths and connector terminations available on request

Accuracy

1 Four central pixels:

Ta = 0 to 50°C

±2.0 ± 0.045*|To-Ta| °C

Remaining pixels:

Ta = 50 to 85°C

±4.0 ± 0.045*|To-Ta| °C

Where TA - Ambient temperature

To - Target object temperature

Mechanical

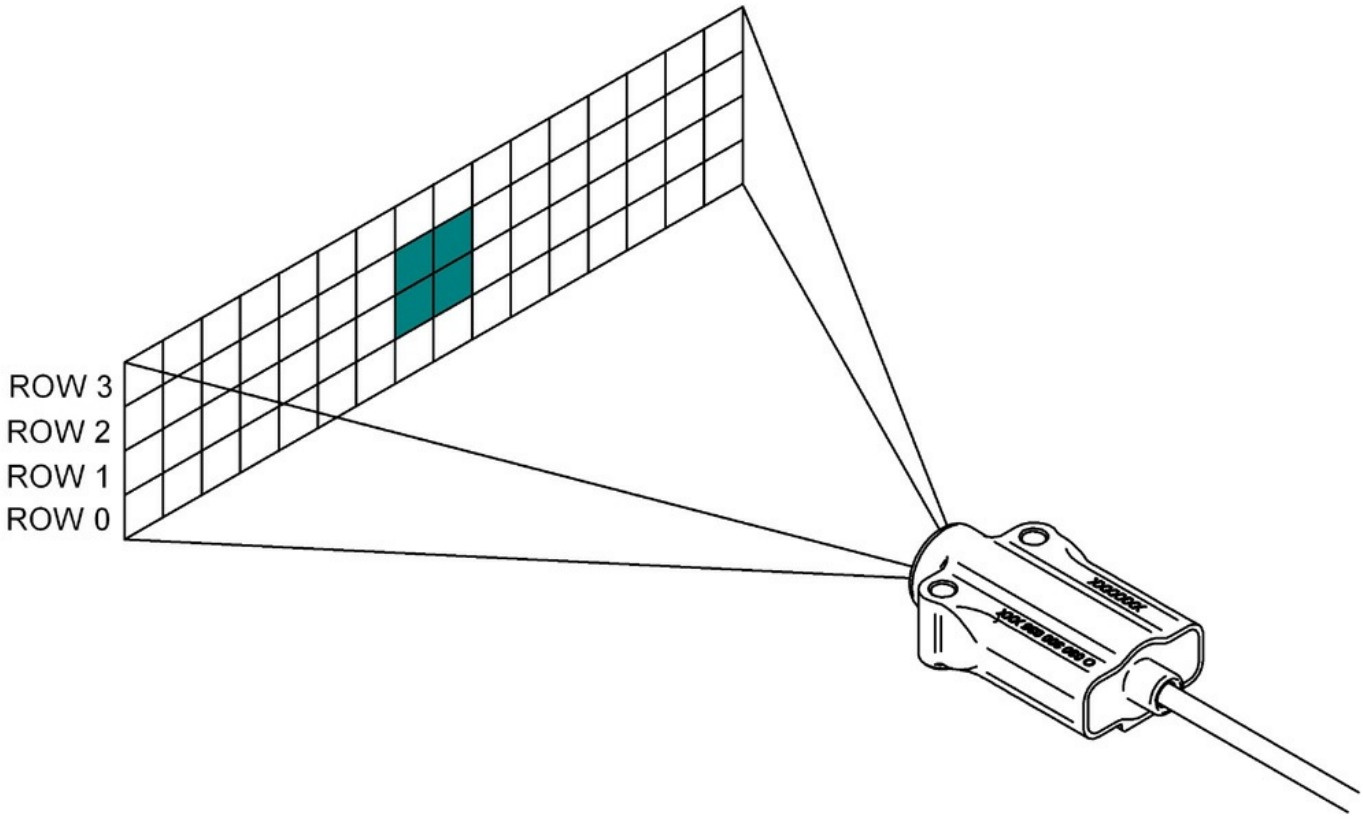
- Weight less than 35g
- DR25 jacketed cable
- Aluminium alloy board hard anodised and dyed black
- Polyester cable boss for strain relief to housing
- Field of view 35° or 60°

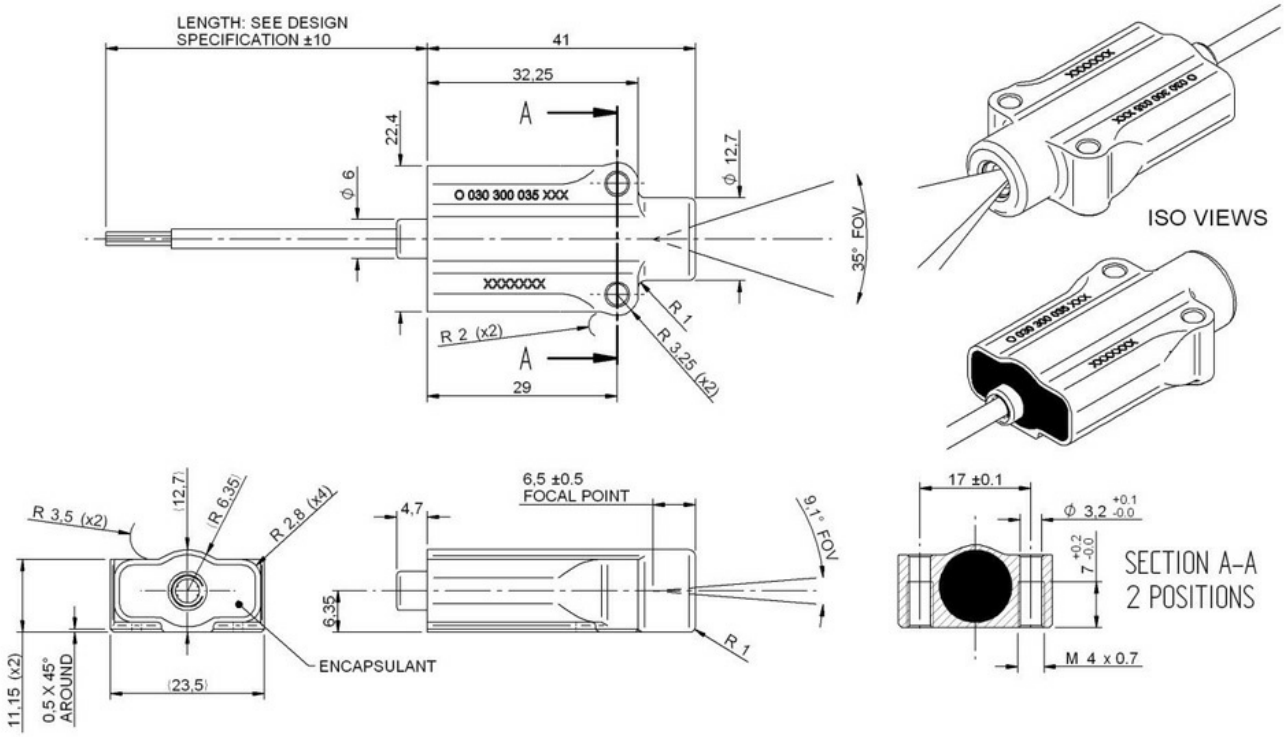
Environmental

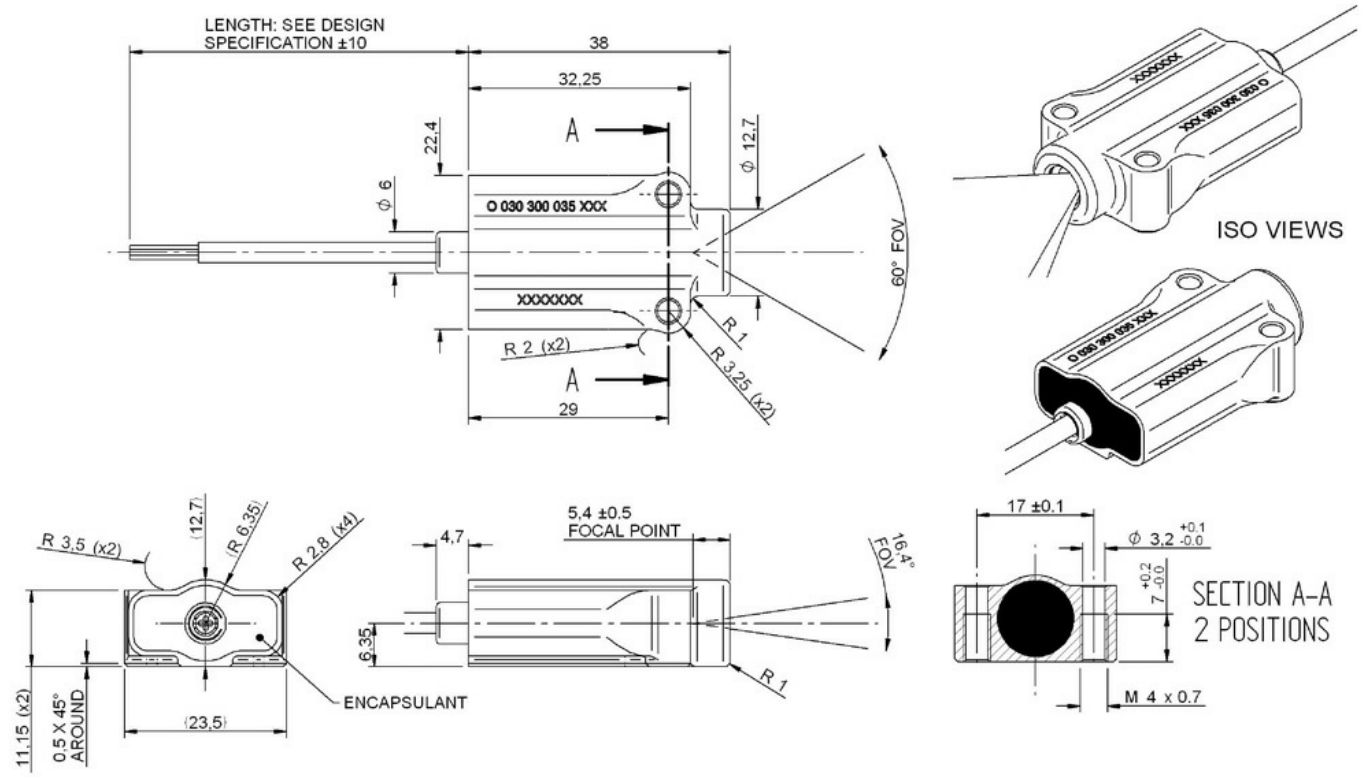
- Resistant to oil, standard fuel, hydraulic fluid and water. Aggressive cleaning agents should not be used, for example freon or trichloroethylene. Alcohol/pure ethanol and a cotton swab can be used for cleaning the lens. Note the sensor reading will change if the lens becomes scratched or dirty
- Maximum humidity 100%
- Operating temperature -25 to +85°C
- Storage temperature -40° to 125°C
- Vibration 500 to 2000Hz, 20g Peak acceleration, 5mins in all
- Shock 1000g peak acceleration, 0.7ms pulse length, 6 directions

Images/Diagrams

Accuracy


ROW 3
ROW 2
ROW 1
ROW 0


LENGTH: SEE DESIGN SPECIFICATION ±10
41
32,25
A
22,4
ϕ 6
ϕ 12,7
O 030 300 035 XXX
XXXXXXX
35° FOV
R 1
R 2 (x2)
R 3,25 (x2)
A
29
ISO VIEWS
R 3,5 (x2)
(12,7)
(R 6,35)
R 2,8 (x4)
6,5 ±0.5
FOCAL POINT
4,7
9,1° FOV
6,35
R 1
17 ±0.1
ϕ 3,2 +0.1 -0.0
7 +0.2 -0.0
SECTION A-A
2 POSITIONS
ENCAPSULANT
11,15 (x2)
0,5 X 45° AROUND
(23,5)
M 4 x 0.7



Ordercodes

Description	Ordercode
1000mm 35° FOV	O 030 300 035 000
1000mm 60° FOV	O 030 300 035 001

Temperature Sensor Infra-Red Brake Temperature

The infra-red sensor measures temperature at a distance without contacting the target. The integrated infra-red module senses the thermal radiation emitted by objects and converts this to an analogue voltage.

In Detail

Electrical

- Supply voltage 7.5 to 16V
- Supply current 1.5mA (typ), 5mA (max)
- Capacitive load 1000 pF
- Resistive load 10k?
- Output resistance 50?
- Accuracy (based on emissivity of 0.98)
- Typical output voltages at an ambient sensor temperature of 25°C for a target which fills the entire field of view and has an emissivity of 0.98 are shown below:

Target temp (°C)	Typical output (V)
200	1.405
300	1.621
350	1.726
400	1.837
450	1.956
500	2.084
550	2.220
600	2.362
700	2.645
800	2.920
900	3.210

1000	3.515
1100	3.744
1200	3.884

- Target temp = (49.907095x
- Carbon emissivity = 0.75
- Steel emissivity = 0.52
- Response time after power up 30ms (typ), 1 sec (max)

Cable and Connection Definition

- 24AWG unscreened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connections:

Red wire	Supply	Pin 1
White wire	Signal	Pin 2
Green wire	Ground	Pin 3
N/C	-	Pin 4

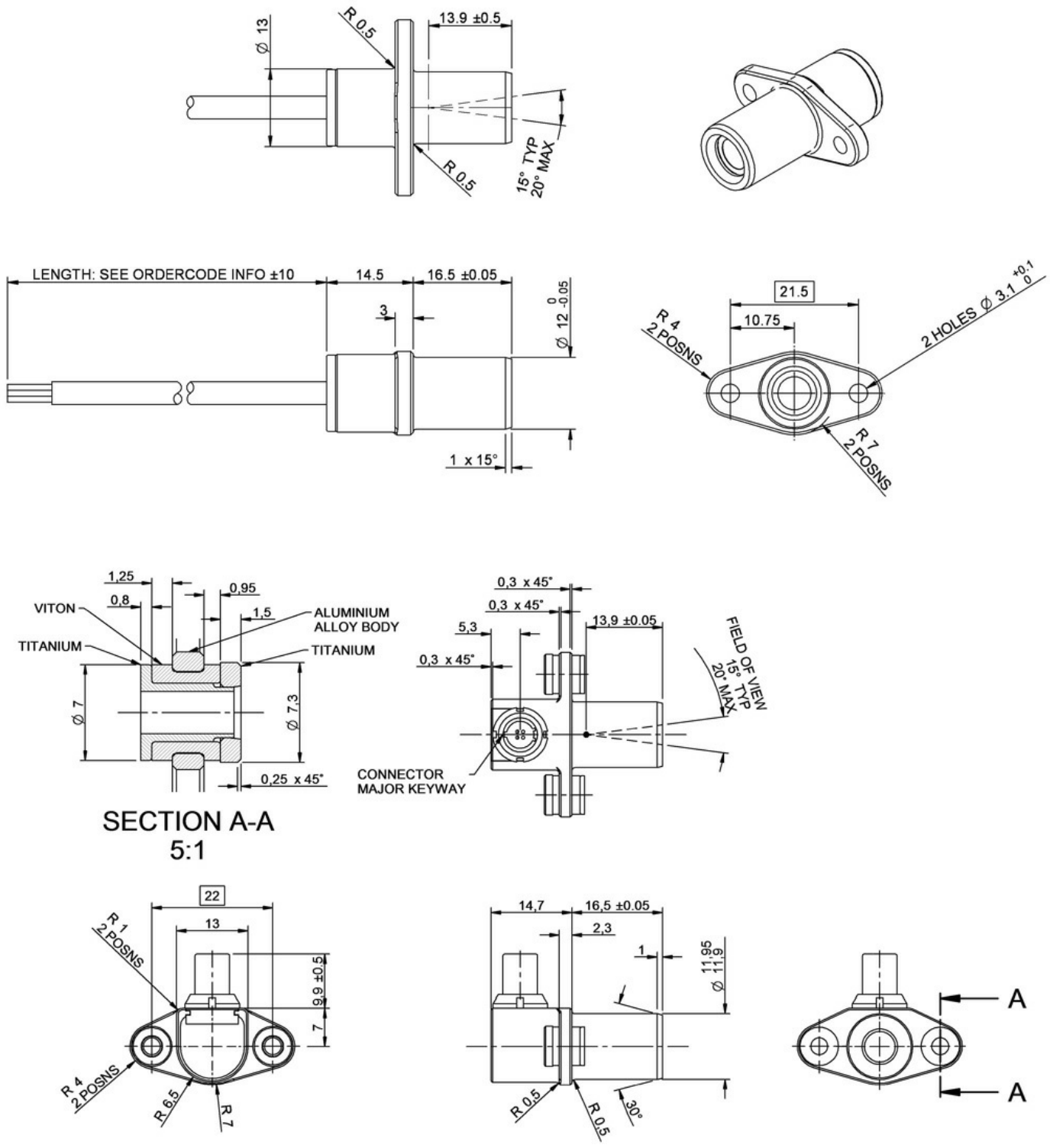
Mechanical

- Weight less than 40g
- Aluminium alloy body hard anodised and dyed black
- Field of view 15° (typ), 20° max
- Optical axis ± 2° max
- Polyester boss for strain relief to the sensor body

Environmental

- Resistant to oil, standard fuel, hydraulic fluid and water. Aggressive cleaning agents should not be used, for example freon or trichloroethylene. Pure ethanol or alcohol and a cotton swab can be used for cleaning the lens.
- The sensor reading will change if the lens becomes scratched or dirty
- Maximum humidity 100%
- Ambient operating temperature -25 to +105°C.
- Target temperature +200 to +1200°C.
- Storage temperature -40° to 125°C
- Viton jacketed cable (200°C)
    - 500 to 2000 Hz, 20g peak acceleration, five mins in all directions
    - 1000g peak acceleration, 0.7ms pulse length, six directions.

Images/Diagrams



Ordercodes

Description	Ordercode
1000mm	O 030 300 030 021
Integral Connector Lemo ECS.FF.304.SLC	O 030 300 030 043

Position

Linear Hall Sensor LHE Sensor

The output of a hall effect sensor is a voltage which changes in proportion to the shaft extension. A constant voltage is required across the supply and ground wires of the sensor. The sensor consists of a Hall Effect element, and a shaft which houses a magnet. When the position of the sensor changes relative to the shaft, the change in magnetic field in the sensor results in a change in output voltage.

In Detail

Electrical

- Electrical stroke 1.157”
- Maximum applied voltage 8.5V
- Supply voltage not to exceed 8.5V
- Supply current <10mA
- Output voltage clampe between 0.1 and 4.9V

Cable and Connection Definition

- 24 AWG un-screened cable
- Cable length 100mm
- Connection
-

Red Wire	Supply
White Wire	Ground
Green Wire	Signal

Application

- Master cylinder displacement measurement

Mechanical

- Aluminium alloy body, anodised and dyed grey
- Weight less than 50g (including cable)
- Polyester cable boss for strain relief to the sensor body
- Non-ferrous shaft to be supplied by customer

Environmental

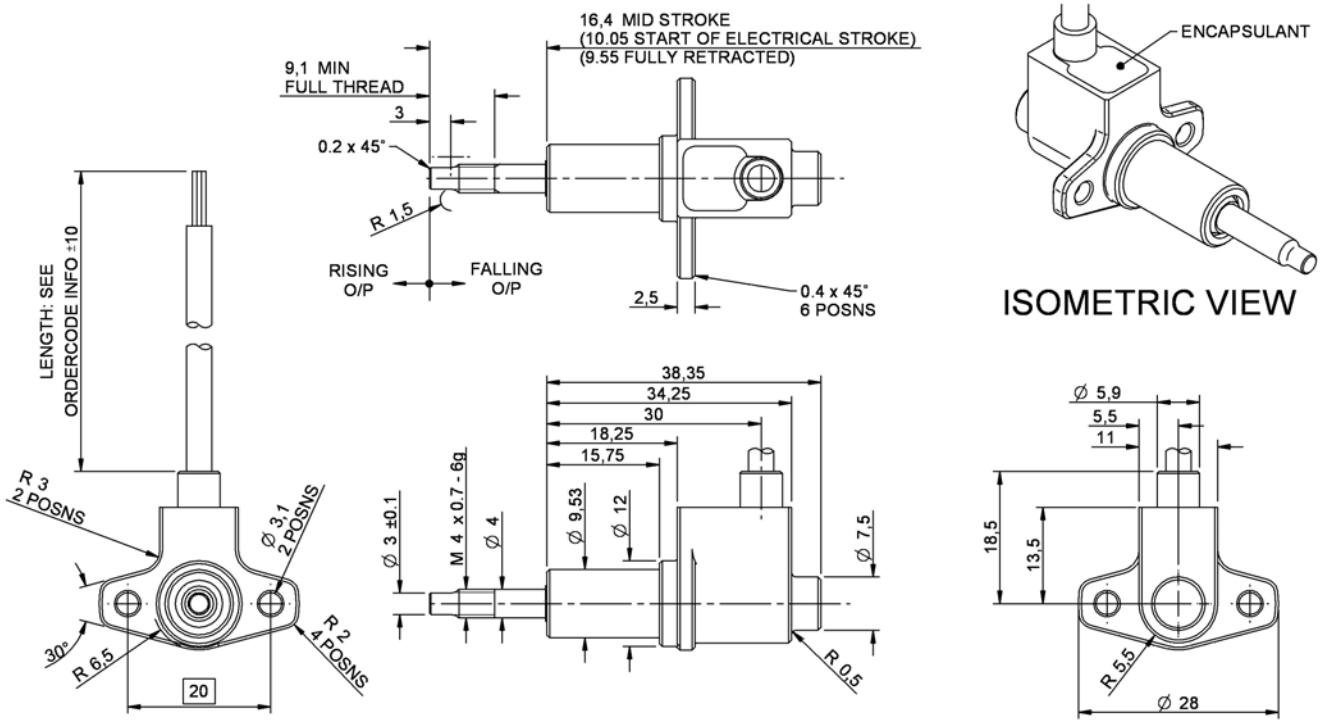
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -40°C to 170°F
- Compensated temperature range 20°C to 150°C
- Viton jacketed cable
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Notes

- Care should be taken to ensure that the shaft/magnet is not placed near to strong magnetic fields, this would result in permanent damage to the sensor.
- Sensor should be kept clear of any stray magnetic fields and ferro-magnetic materials during operation.

Images/Diagrams

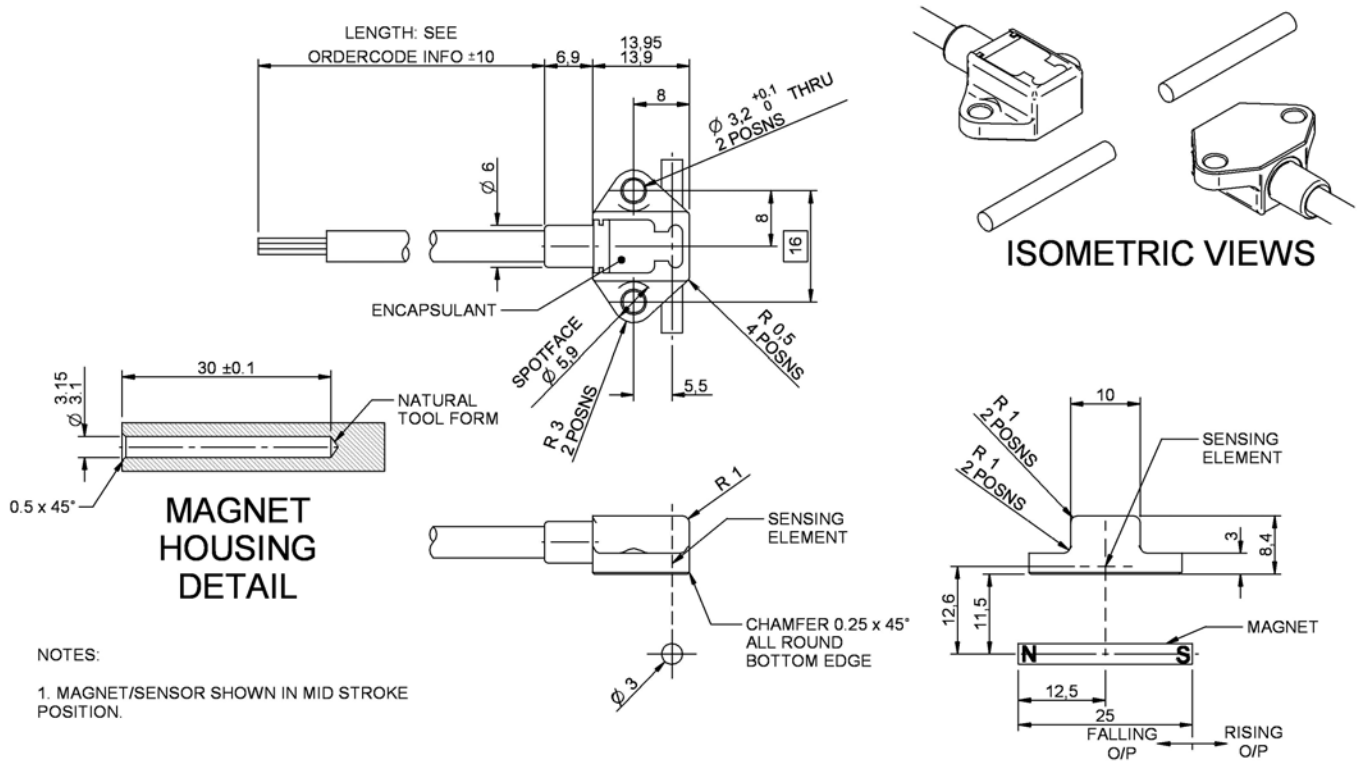
O 030 320 009 043



NOTES:

1. SHAFT SHOWN IN MID STROKE POSITION.

O 030 320 009 053



Ordercodes

Description	Ordercode
Linear Hall Effect Sensor - shafted	O 030 320 009 043
Linear Hall Effect Sensor - Shaftless	O 030 320 009 053

Linear Variable Differential Transformer

AC to DC Converter

The output of a Linear Variable Differential Transformer (LVDT) is an alternating voltage with a magnitude which varies in proportion to the position of a magnetic core within the sensor. The output of the AC to DC converter is a DC voltage, in the 0 to 5V range, which is also proportional to core location. The converter also supplies the AC excitation voltage for the LVDT. The interface is available either as a circuit board for OEM installations or encapsulated in a heatshrink boot.

In Detail

Application

- Conversion of LVDT output to a linear, DC signal in the 0 to 5V range.

Electrical

The following electrical characteristics are to suit a Schaevitz MHR1000 LVDT (Sensitivity 30mv/v/mm, Stroke ±25.4mm, Secondary to Primary transformer ratio at null 2). The interface can be configured for other LVDTs. Please contact our technical consultancy service if you require this service.

- Supply voltage 10 ±0.4V DC regulator
- Supply current 35mA max
- Output range 4 ±0.2V DC for full stroke of LVDT
- Output for zero displacement 2.5 ±0.1V DC
- Maximum output voltage ±10V DC
- Bandwidth 1kHz (can be adjusted during manufacture)
- Excitation voltage 2.2 ±0.25V rms (other voltages can be supplied)
- Excitation frequency 10kHz ±10% (other frequencies between 20Hz and 20kHz can be supplied)

Zero displacement is at the centre of the LVDT. Output decreases as the cores moves into secondary A and increases as it moves into secondary B.

Mechanical (Encapsulated unit)

- Weight less than 70g including cable
- Elastomer boot for strain relief to the interface body

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Cable and Connection Definition

- Input cable (where fitted) 24 AWG five-core screened
- Output cable (where fitted) 22 AWG three-core screened
- Cable length (where fitted) is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Input Connection:
-

Red Wire	Pin A	Pin 1	Primary +
Black Wire	Pin B	Pin 2	Primary –
Green Wire	Pin C	Pin 3	Secondary A
Blue Wire	Pin D	Pin 4	Secondary B
White Wire	Pin E	Pin 5	Secondary Centre

- Output Connection:
-

Red Wire	Pin A	Pin 1	DC Supply
Green Wire	Pin B	Pin 2	Output Signal
White Wire	Pin C	Pin 3	Ground

The interface is protected against reverse polarity on the supply.

Environmental

- Resistant to standard motorsport fluids (encapsulated unit)
- Maximum humidity 100% (encapsulated unit)
- Operating temperature 0 to 70°C
- Storage temperature -20 to +85°C
- DR25 jacketed cable (encapsulated unit)
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Ordercodes

Description	Ordercode
	O 030 200 002 003
Circuit Only	O 030 200 002 006

Rotary Hall Effect Sensor RHE Sensor

The output of the Rotary Hall-effect sensor is a voltage which changes in direct proportion to the shaft angle. The sensor is non-contact, using Hall elements to determine the angle of a magnet. The magnet is either mounted in a shaft integral to the sensor or can be mounted externally to the sensor. An integral shield is available to reduce interference from nearby ferrous objects and stray magnet fields. Supply voltage is either 5.00V ratiometric or 9..13V. Angular ranges up to 360° and output ranges between 0.2 and 4.8V are available.

In Detail

Electrical

- Supply Voltage 5.00±0.5V d.c. ratiometric or 9..13V d.c.
- Overvoltage protection 20V
- Reverse polarity protection -10V for 5V supply,

-20V for 9..13V supply

- Supply current 16mA max per channel
- Output current 8mA max
- Output load >10kOhm recommended
- Start up cycle 15ms
- Angular range 360° (unless otherwise stated)
- Output voltage 0.2 to 4.8V (unless otherwise stated)
- Independent non-linearity 1.0% FSO max
- Thermal drift
- 0.3%FSO max (20..150°C) for 5V supply
- 0.5%FSO max (20..150°C) for 9..13V supply
    - Half-voltage position tolerance ±2° max
    - Sampling rate 200µs (5kHz)
    - Resolution <0.1°
    - Shaft rotation direction for a rising or falling output is shown on drawing
    - Shaft orientation for half-voltage position is shown on drawing

Cable and Connection Definition

- 55 spec 26AWG unscreened cable
- Cable length 1000mm
- Connection

Red wire Supply A

White wire Signal A

Blue wire Ground A

Orange wire[1] Supply B

Yellow wire[1] Signal B

Green wire[1] Ground B

[1]For 2 channel sensors.

Mechanical

- Weight less than 20g (excluding cable)
- Aluminium alloy body, hard anodised and dyed black
- Stainless steel shaft(where fitted)
- Internal shield to prevent interference from stray magnetic fields or nearby ferrous objects(where fitted)
- Polyester cable boss for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- DR25 jacketed cable
- Operating temperature -40 to +150°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Shock 50g ½ sine 11ms 10 times per axis

Notes

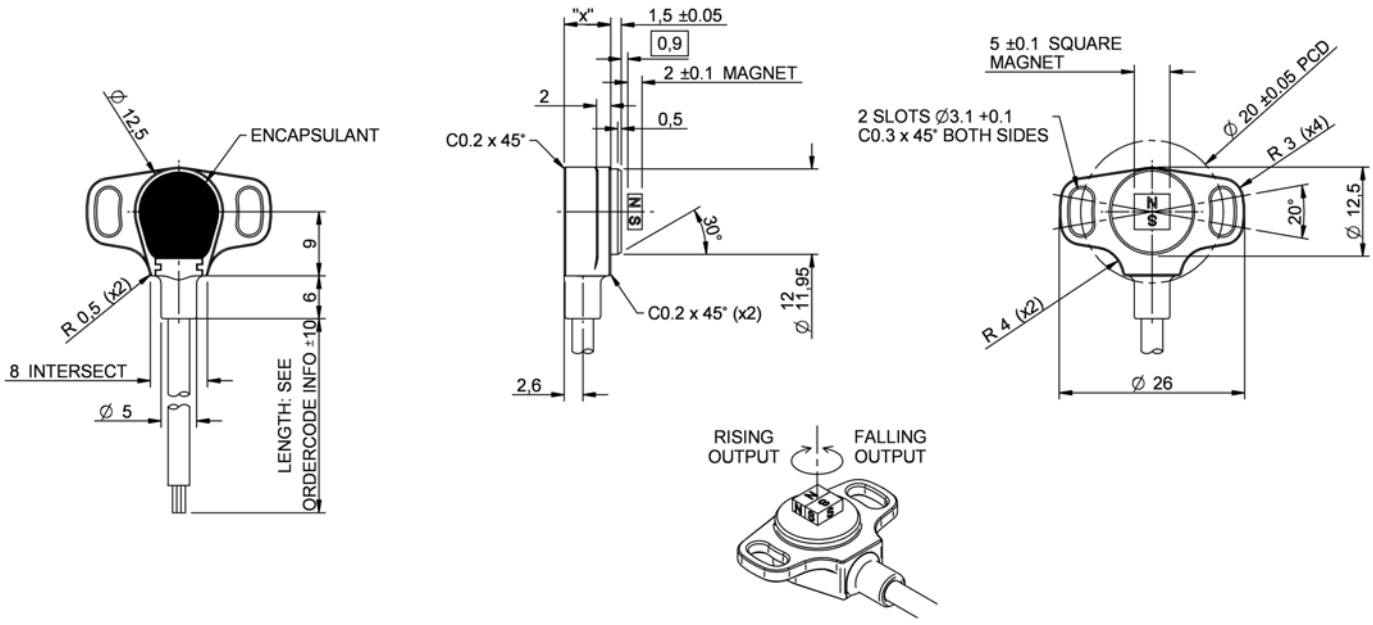
Stray magnetic fields (>0.1mT) or nearby ferrous objects (<20mm away) may affect the output on sensors without an integral shield.

Design and manufacture is in-house, so if our existing designs do not suit your application we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable lengths or angular range. Please contact our technical consultancy service who will be pleased to help.

Images/Diagrams

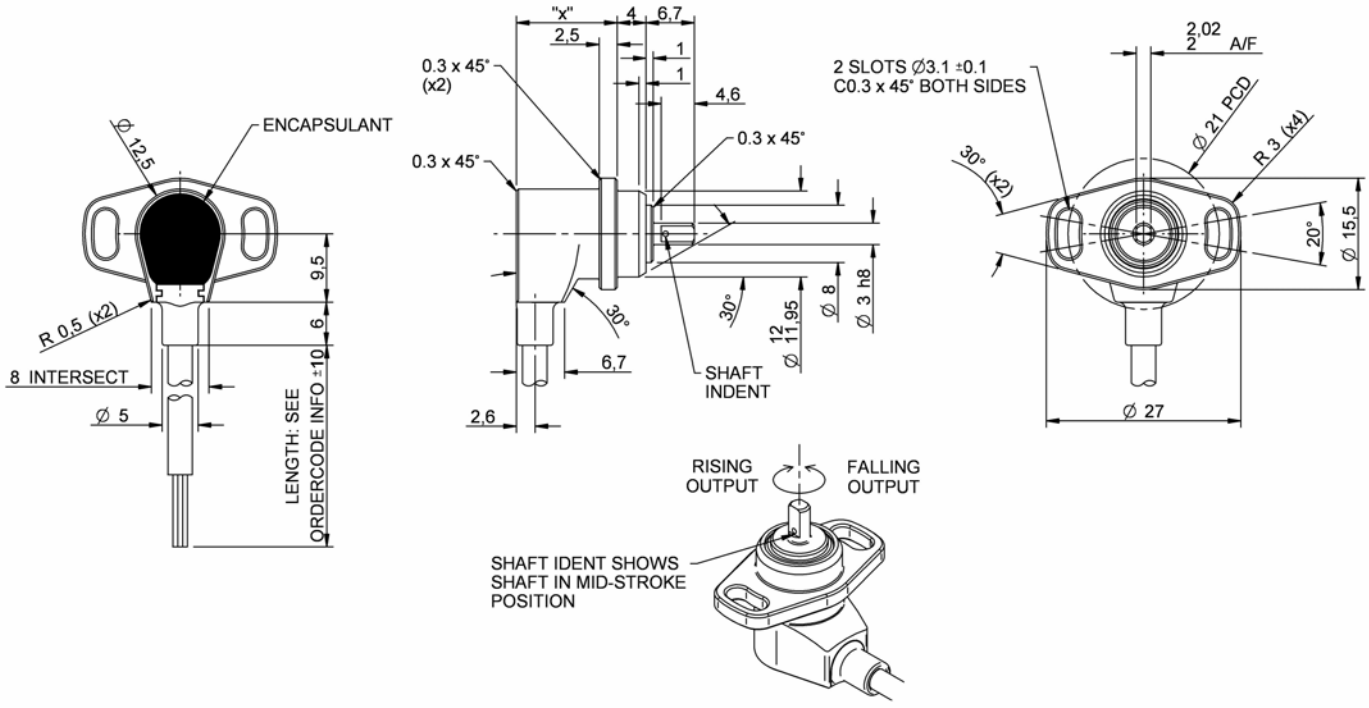
Shaftless RHE

O 030 370 021 001



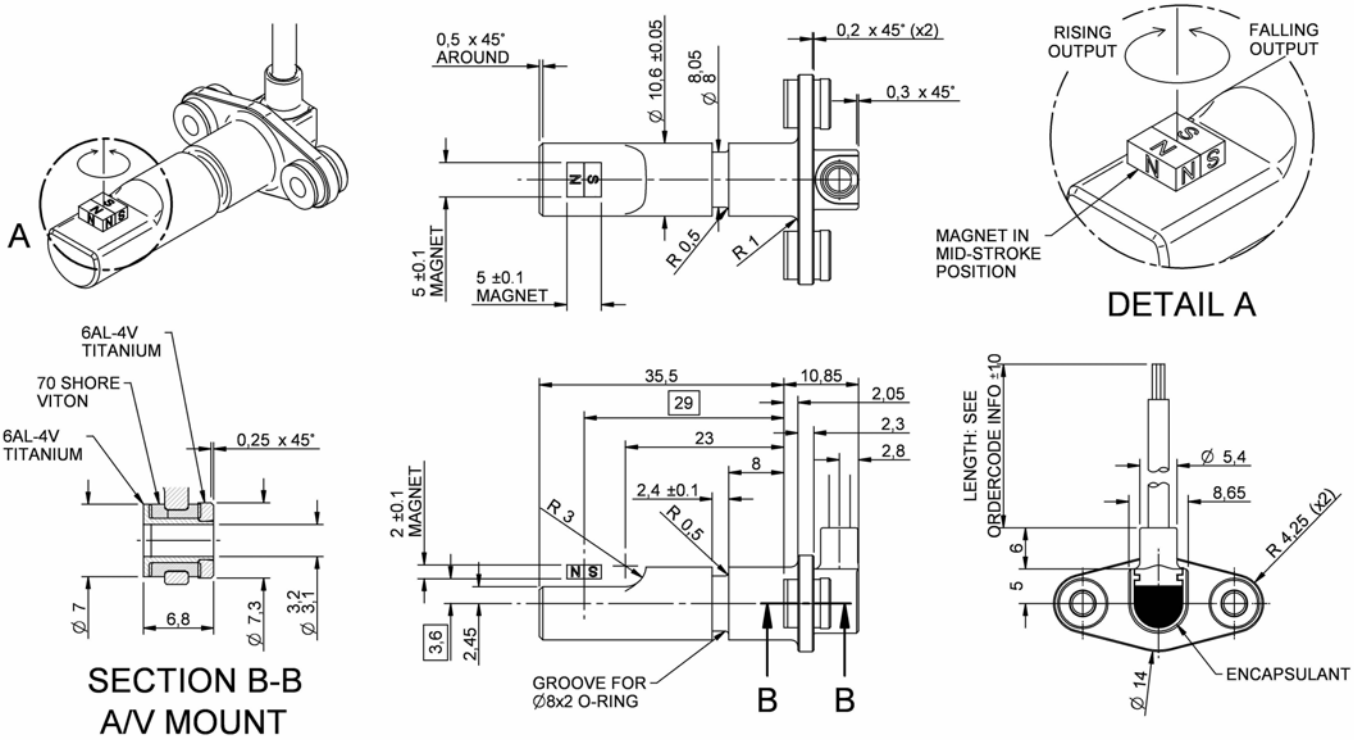
Shafted RHE

O 030 370 021 006



Shaftless RHE extended

O 030 370 021 018


A
0,5 x 45°
AROUND
Ø 10,6 ±0,05
Ø 8,05
0,2 x 45° (x2)
0,3 x 45°
5 ±0,1
MAGNET
5 ±0,1
MAGNET
R 0,5
R 1
RISING
OUTPUT
FALLING
OUTPUT
MAGNET IN
MID-STROKE
POSITION
DETAIL A
6AL-4V
TITANIUM
70 SHORE
VITON
6AL-4V
TITANIUM
0,25 x 45°
Ø 7
6,8
Ø 7,3
3,2
Ø 3,1
SECTION B-B
A/V MOUNT
35,5
29
10,85
2,05
2,3
2,8
23
8
2,4 ±0,1
R 3
R 0,5
2 ±0,1
MAGNET
3,6
2,45
GROOVE FOR
Ø8x2 O-RING
B
B
LENGTH: SEE
ORDERCODE INFO ±10
Ø 5,4
8,65
R 4,25 (x2)
6
5
Ø 14
ENCAPSULANT

Pressure (Aero)

Barometric and Temperature Sensor Single Channel

The output voltage changes with the absolute pressure applied to the pressure port. The gain, offset and thermal drift of the pressure sensor is digitally compensated to minimise errors and to create a single-ended, amplified output in the 0 to 5 Volt range.

In Detail

Electrical

- Compensated pressure range 150 to 1150mbar (absolute)
- Supply voltage 8 to 16V unregulated
- Supply current 14mA max
- Output voltage @ 150mbar (absolute pressure) = 0.5V ±0.05V @25°C
- Output voltage @ 1150mbar (absolute pressure) = 4.5V ±0.05V @25°C
- Maximum output voltage 5V
- Non-%FSO max
- %FSO
- Combined thermal zero and sensitivity shift □±1.5
- -3dB point at 100Hz, single pole filter
- Maximum sink / source current 0.45mA

The sensor is protected against short circuit between output and ground but it may be damaged if the output is connected to the supply or if a reverse bias supply voltage is applied.

Cable and Connection Definition

False

Temperature

- Sensing element PT1000
- Nominal resistance: 1000□ at 0°C
- Accuracy: ±0.4k typ, ±1.0k max (0 to +70°C)
- Response time 4 sec typ, 10 sec max in still air
- Sensor characterised to 70°C
- PT1000 sensing element tip supported by RTV

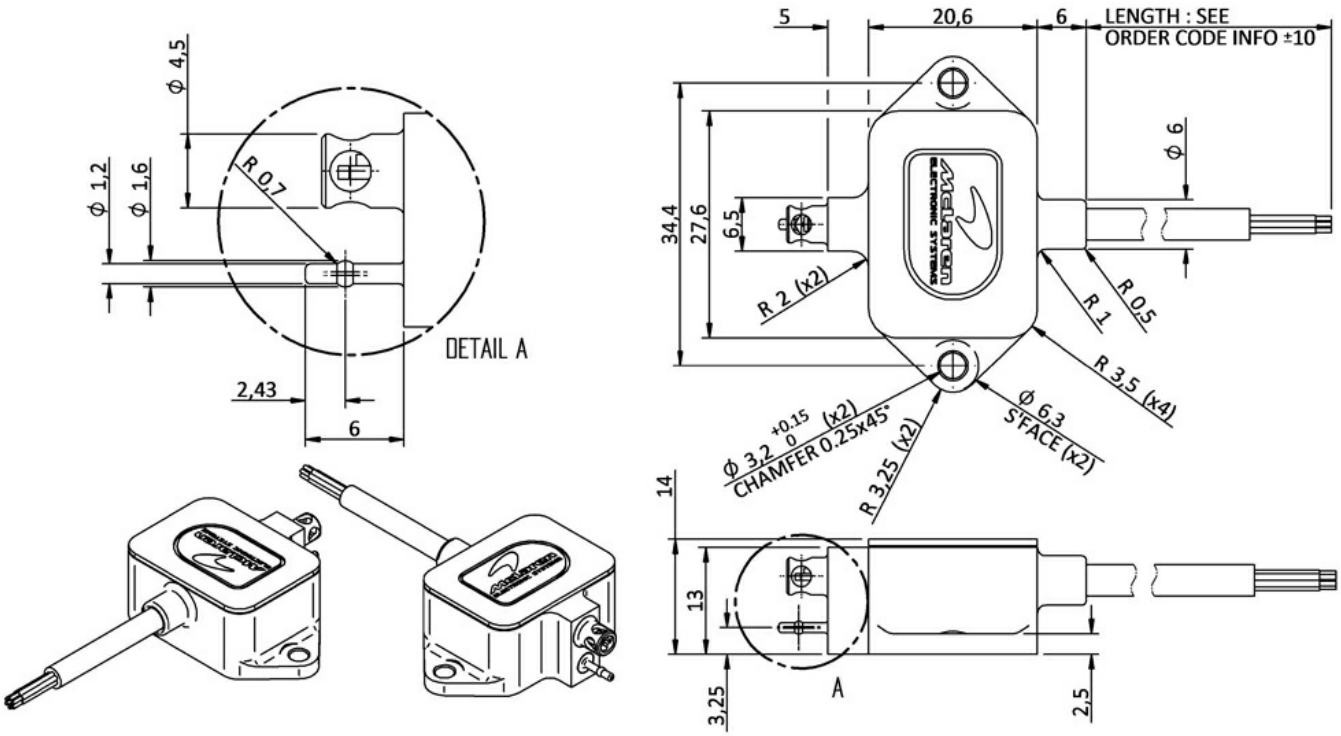
Mechanical

- Weight less than 55g (including cable and connector)
- Aluminium alloy body hard anodised grey
- Sensor is supplied with viton o-ring (where applicable)

Environmental

- Maximum pressure 4000mbar (absolute pressure)
- Pressure media must be a non-corrosive gas
- Sensor body resistant to standard motorsport fluids
- Maximum humidity 100% but water should not be allowed to condense inside the unit
- Operating temperature -40 to +125°C
- Compensated temperature range 0 to 125°C
- DR25 jacketed cable (150°C)
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Images/Diagrams



Ordercodes

Description	Ordercode
500mm	O 030 330 043 055

Barometric Sensor 1 Channel

The output voltage changes with the absolute pressure applied to the pressure port. The gain, offset and thermal drift of the pressure sensor is digitally compensated to minimise errors and to create a single-ended, amplified output in the 0 to 5 Volt range.

In Detail

Electrical

False

Cable and Connection Definition

False

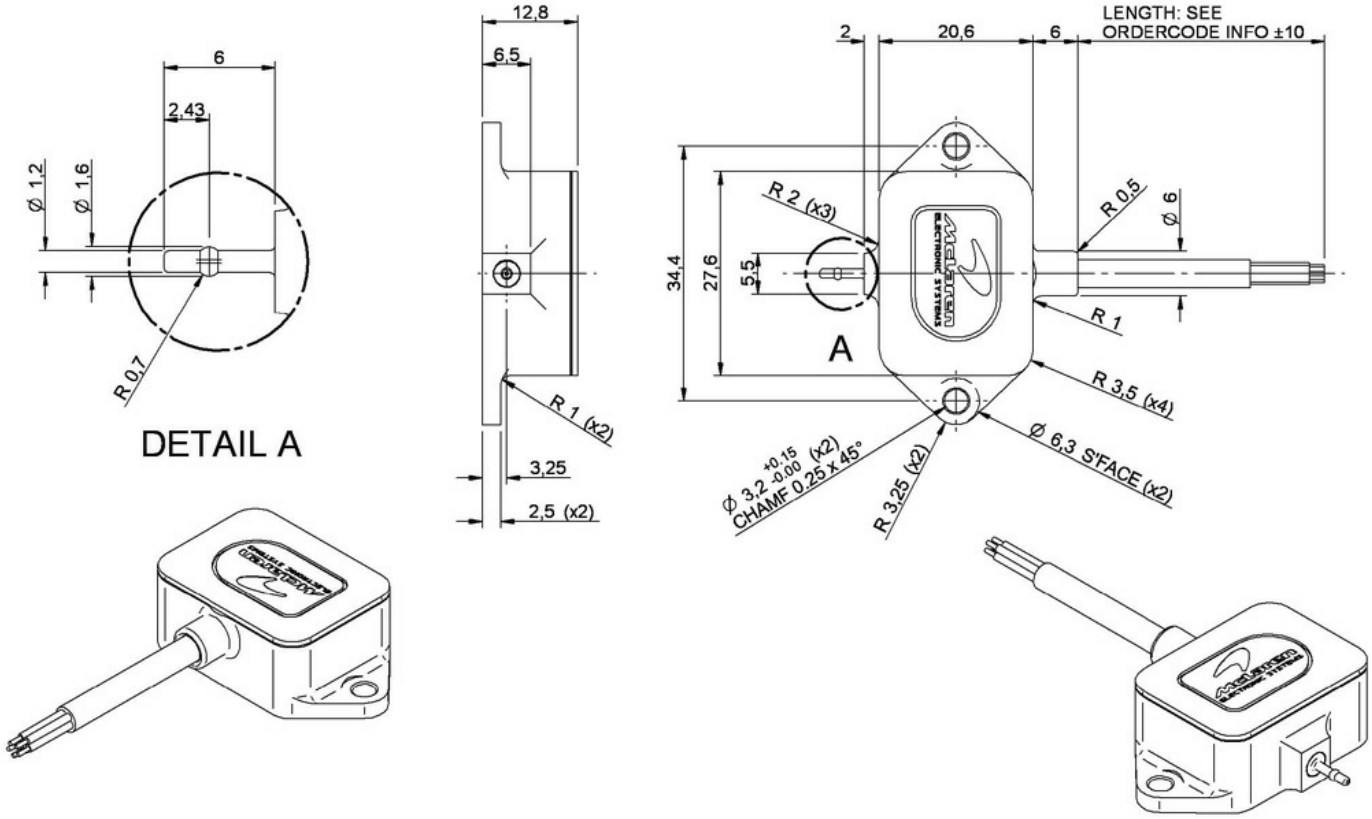
Mechanical

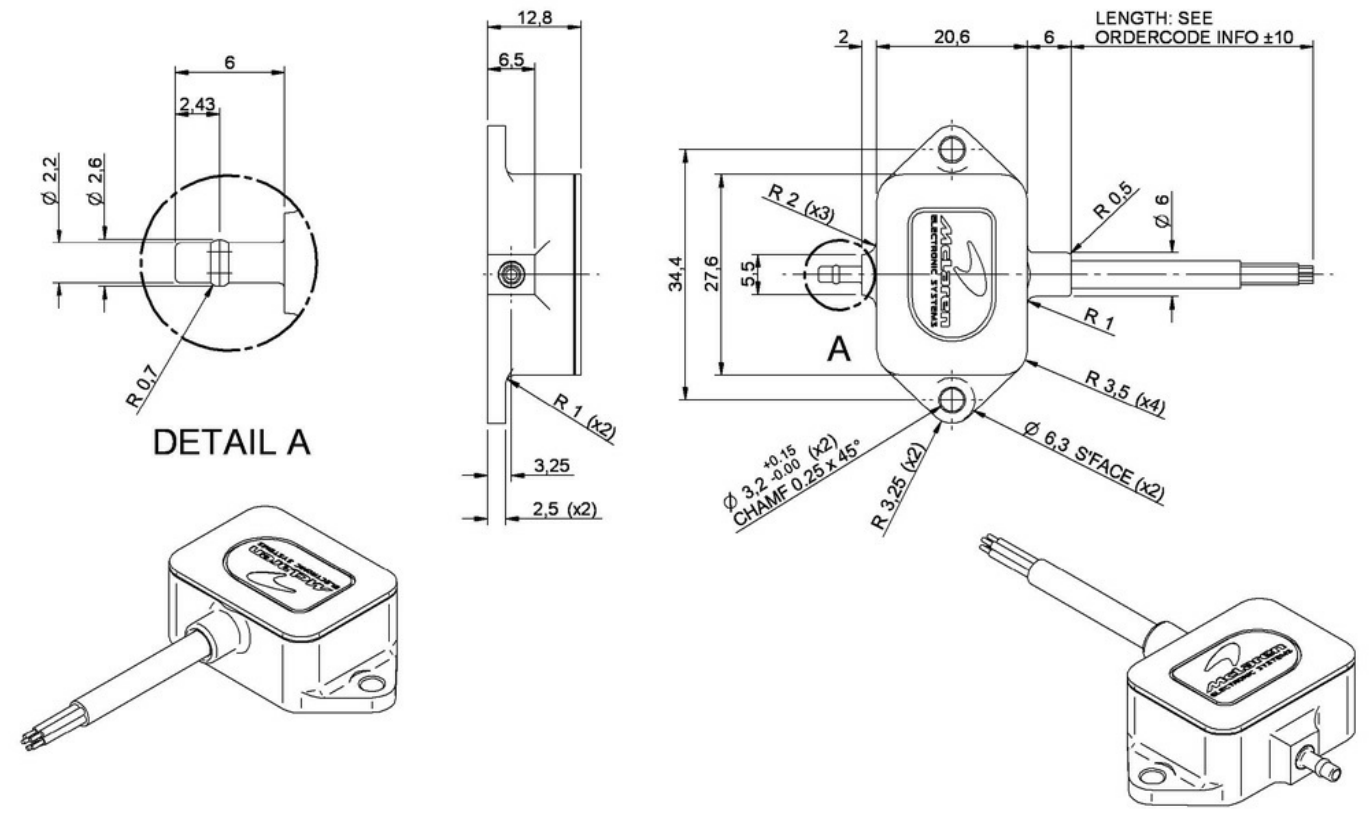
- Weight less than 50g (including cable and connector)
- Aluminium alloy body hard anodised black
- Sensor is supplied with viton o-ring (where applicable)

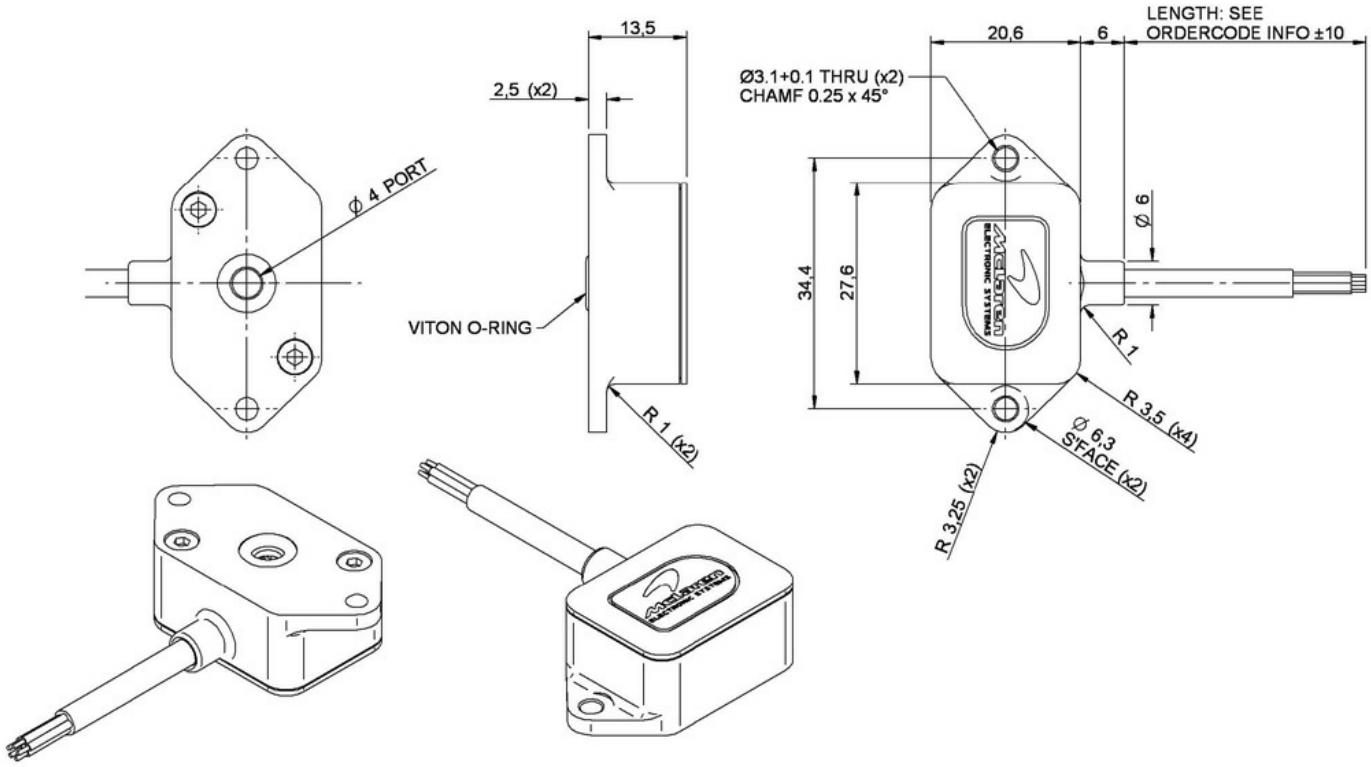
Environmental

- Maximum pressure 4000mbar (absolute pressure)
- Pressure media must be a non-corrosive gas
- Sensor body resistant to standard motorsport fluids
- Maximum humidity 100% but water should not be allowed to condense inside the unit
- Operating temperature -40 to +125°C
- Compensated temperature range 0 to 125°C
- Viton jacketed cable (200°C)
- Vibration 50 to 2500Hz @ 40g eight hours per axis

Images/Diagrams


6
2,43
Ø 1,2
Ø 1,6
R 0,7
DETAIL A
12,8
6,5
R 1 (x2)
3,25
2,5 (x2)
LENGTH: SEE
ORDERCODE INFO ±10
2
20,6
6
34,4
27,6
5,5
R 2 (x3)
R 0,5
Ø 6
R 1
A
R 3,5 (x4)
Ø 3,2 +0,15 -0,00 (x2)
CHAMF 0.25 x 45°
R 3,25 (x2)
Ø 6,3 S'FACE (x2)


6
2,43
Ø 2,2
Ø 2,6
R 0,7
DETAIL A
12,8
6,5
R 1 (x2)
3,25
2,5 (x2)
LENGTH: SEE
ORDERCODE INFO ±10
2
20,6
6
34,4
27,6
5,5
R 2 (x3)
R 0,5
Ø 6
R 1
A
R 3,5 (x4)
Ø 3,2 +0,15 -0,00 (x2)
CHAMF 0.25 x 45°
R 3,25 (x2)
Ø 6,3 S'FACE (x2)



Ordercodes

Description	Ordercode
1000mm	O 030 330 043 047
1000mm	O 030 330 043 048
1000mm	O 030 330 043 049
Spare O-Ring Seal	O 030 300 990 006

Barometric Sensor 4 Channel

The output voltage changes with the absolute pressure applied to the pressure port. The gain, offset and thermal drift of the pressure sensor is digitally compensated to minimise errors and to create a single-ended, amplified output in the 0 to 5 Volt range.

In Detail

Application

- Absolute pressure measurement of non-corrosive gas, e.g. aerodynamic or cylinder-to-cylinder pressures.

Electrical

- Compensated pressure range 150 to 1150mbar (absolute)
- Supply voltage 8 to 16V unregulated
- Supply current 30mA max
- Output voltage @ 150mbar (absolute pressure) = 0.5V ±0.05V measured at 25°C
- Output voltage @ 1150mbar (absolute pressure) = 4.5V ±0.05V measured at 25°C
- Maximum output voltage 5V
- Non-linearity ±0.5%FSO typ ±1.0%FSO max
- Hysteresis ±0.5%FSO
- Combined thermal zero and sensitivity shift ±1.5%FSO typical, ±2% FSO max
- -3dB point at 100Hz, single pole filter
- Maximum sink/source current 0.45mA

The sensor is protected against short circuit between output and ground but it may be damaged if the output is connected to the supply or if a reverse bias supply voltage is applied.

Other pressure ranges available on request.

Cable and Connection Definition

- 55Spec 26AWG unscreened cable
- Connection details
-

Red wire	Supply

Black wire	Ground
Orange wire	Pressure Signal A
Yellow wire	Pressure Signal B
Green wire	Pressure Signal C
Blue wire	Pressure Signal D
White wire x 4	Diagnostic - do not connect

- Cable length is shown on order details, but any length is available on request

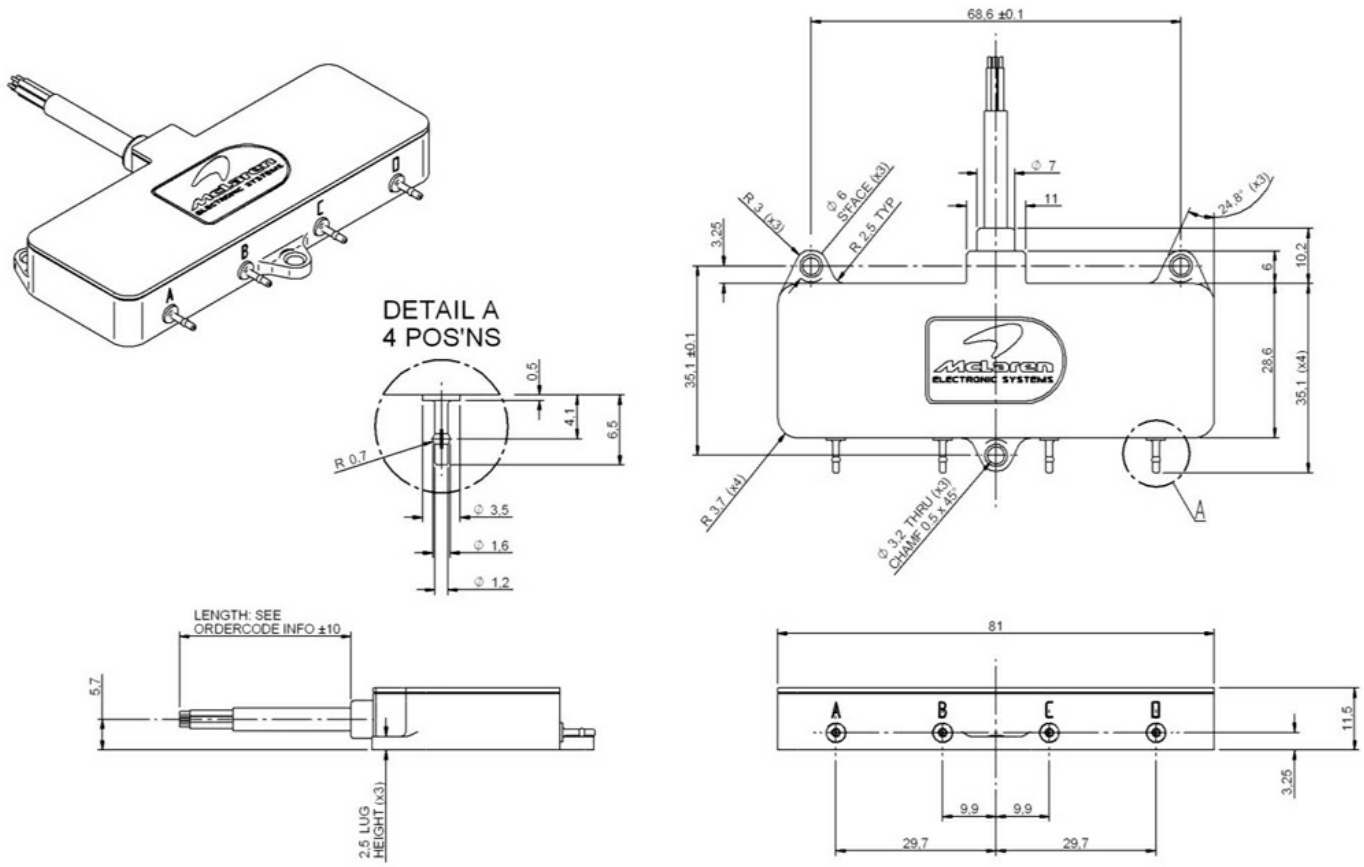
Mechanical

- Weight less than 120g (including cable)
- Aluminium alloy body hard anodised black

Environmental

- Maximum pressure 4000mbar (absolute pressure)
- Pressure media must be a non-corrosive gas
- Body resistant to standard motorsport fluids
- Maximum humidity 100% but water should not be allowed to condense inside the unit
- Operating temperature range -40 to +125°C
- Compensated temperature range 0 to +125°C
- DR25 jacketed cable
- Vibration 50 to 2500Hz @ 40g eight hours per axis

Images/Diagrams



Ordercodes

Description	Ordercode
1000mm	O 030 330 043 046

Pitot Sensor Mini

This module is typically used as a Pitot tube sensor. The output voltage changes with the difference in pressure between the two ports, it is insensitive to variations in ambient pressure. The outputs are single ended and so the sensor can be connected directly to most control units and data loggers. The voltage output from the sensor is sampled and calibration corrected.

The standard measurement range is ±35mbar, other pressure ranges available.

In Detail

Application

- Pitot tube

Electrical

0

Cable and Connection Definition

- 26 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connnection
-

Red wire	Supply
Green wire	Ground
White wire	Signal

Mechanical

- Measurement range (differential) ±34.47mbar
- Rated pressure 34.47mbar
- Maximum differential pressure 2 x rated pressure
- Aluminium alloy body, anodised and dyed black
- Weight 23g including cable
- Titanium pressure ports

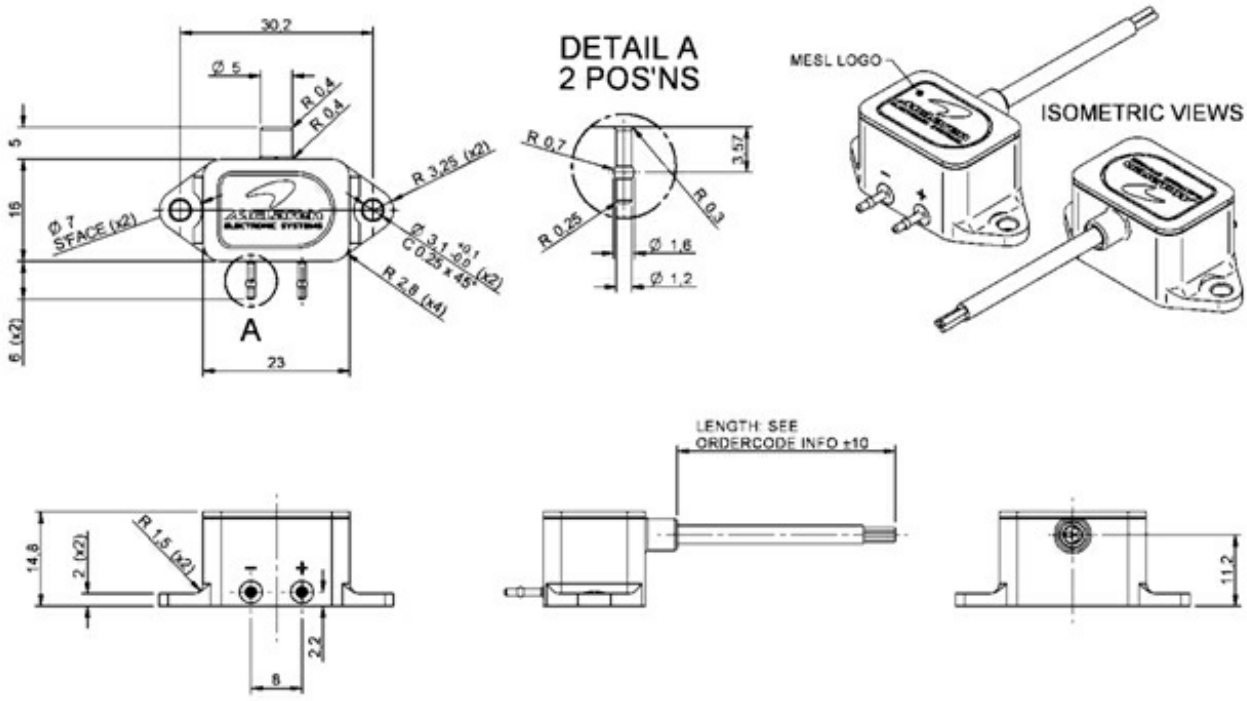
Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Body resistant to standard motorsport fluids
- Exposure of non-corrosive gas to both reference and input ports. Ports should be sealed when not in use
- Maximum humidity 100%
- Operating temperature 0 to +125°C
- Compensated temperature range 0 to +70°C
- Vibration 100 to 1000Hz, 24hrs per axis

Images/Diagrams

O 030 330 005 033



Ordercodes

Description	Ordercode
	O 030 330 005 033

Pitot Sensor 8 Channel

This module is typically used for aerodynamic development, whereby pressure tappings can be made across surfaces of wings and aero features of the vehicle. The scaled pressure results are transmitted over CAN to the host controller and/or data logger.

In Detail

Application

- Aerodynamic development.

Electrical

- Supply voltage 8 to 16V unregulated
- Supply current 80mA max @ 12V
- Output at +68.95 mbar (1 psi) = 0.5V ±0.06V @25°C
- Output at -275.8 mbar (-4 psi) = 4.5V ±0.06V @25°C
- Output voltage represented by an 11-bit integer
- Resolution (11-bit ADC) 2.44mV 0.21mbar
- Combined accuracy <±1.5% FSO over compensated temperature range (<±3.5% FSO for remainder of operating temperature)
- -3dB at 159Hz
- ISO11898 1Mbit/s CAN communications link for configuration and results data
- CAN sampling rate configured by host ECU up to 1kHz
- CAN message identifiers configured by host ECU allowing multiple modules sharing a common bus (a fixed CAN identifier will be required for configuration messages)
- CAN bus link must be terminated using 120ohm resistor
- 3 CAN messages are required to transmit 8 x 11 bit pressure outputs

For each channel, the output changes when the pressure at the port for that channel is higher or lower than the pressure at the REF port.

Connection Definition

- ASX202-06PN Deutsch Connector
- Connetion:

-

Pin 1	Supply
Pin 2	Ground
Pin 3	CAN +
Pin 4	CAN -
Pin 5	Not connected
Pin 6	Not connected

Mechanical

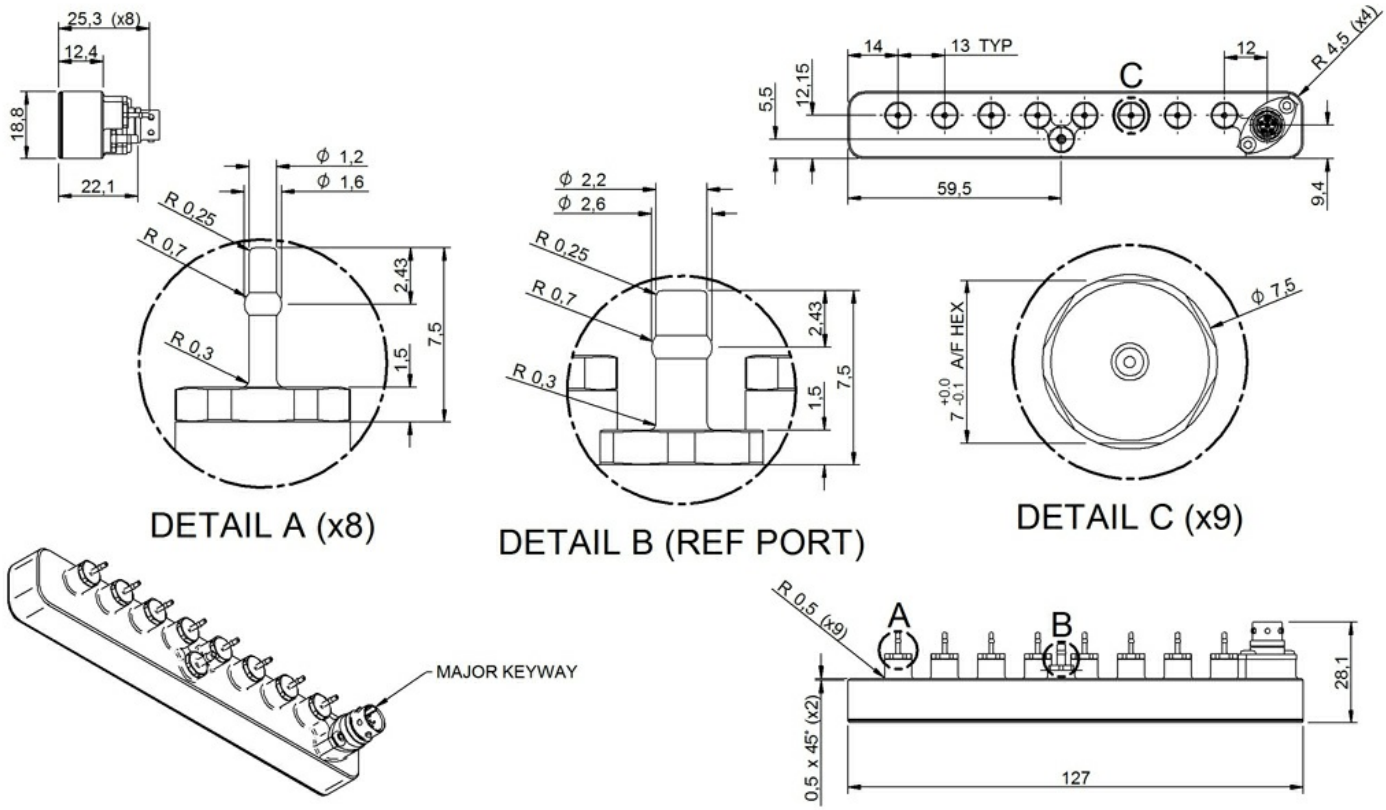
- Measurement range +68.95 to -275.8 mbar differential
- Maximum differential pressure 2 x rated pressure
- Weight less than 70g
- Aluminium alloy body, anodised and dyed black
- Threaded titanium pressure ports (serviceable)

Environmental

- Body resistant to standard motorsport fluids
- Exposure of non-corrosive gas to ports 1-8 only. Reference port is vented to case and should therefore be exposed to dry gasses only. Ref port should be sealed when not in use.
- Maximum humidity 100%
- Operating temperature 0 to +115°C
- Compensated temperature 0 to +70°C
    - 100Hz, 0.00797g
    - 200Hz, 0.17157g
    - 300Hz, 0.54279g
    - 650Hz, 0.00965g
    - 1000Hz, 0.02080g

Operating Temp (°C)	Max Supply Voltage (V)	Max Current Consumption (mA)
115 - 120	14	70
120 - 125	10	90

Images/Diagrams



Ordercodes

Description	Ordercode
CAN Output PIN8 Pitot Sensor	O 030 330 005 060

Pitot Sensor 16 Channel

This multi-channel pressure module is typically used for aerodynamic development, whereby pressure tappings can be made across surfaces of wings and aero features over the vehicle.

Analogue and CAN output variants are available. Scaled pressure results are either transmitted over CAN to the host controller and/or data logger, or are single ended analogue outputs which can be connected directly to most control units and data loggers.

In Detail

Application

- Aerodynamic development.

Electrical

See ordercode for range and output details.

Mechanical

- Maximum differential pressure two x rated pressure
- Weight less than 95g (CAN version), 110g (Analogue version)
- Aluminium alloy body, anodised and dyed black
- Titanium pressure ports
- Other pressure connections and orientations are available upon request

CAN Messaging

- ISO11898 1Mbit/s CAN communications link for configuration and results data
- CAN sampling rate configured by host ECU up to 1kHz
- CAN message identifiers configured by host ECU allowing multiple modules sharing a common bus (a fixed CAN identifier will be required for configuration messages)
- CAN bus link must be terminated using 120 resistor
- Four CAN messages are required to transmit 16 x 11-bit pressure outputs

Environmental

- Body resistant to standard motorsport fluids
- Exposure of non-corrosive gas to ports 1-16 only. Reference port is vented to case and should therefore be exposed to dry gasses only. REF port should be sealed when not in use.

- Maximum humidity 100%
- Operating temperature 0 to +115°C
- Compensated temperature 30 to +70°C
    - 100Hz, 0.00797g
    - 200Hz, 0.17157g
    - 300Hz, 0.54279g
    - 650Hz, 0.00965g
    - 1000Hz, 0.02080g

Operating Temp (°C)	Max Supply Voltage (V)	Max Current Consumption (mA)
115 - 120	14	80
120 - 125	10	100

Connection Definition – Analogue Variant

- Connector A (ASDD0-06-09-PN)

Pin 1	Channel 1
Pin 2	Channel 2
Pin 3	Channel 3
Pin 4	Channel 4
Pin 5	Channel 5
Pin 6	Channel 6
Pin 7	Channel 7
Pin 8	Channel 8
Pin 9	Channel 9

- Connector B (ASDD0-06-09-PA):

Pin 1	Channel 10
Pin 2	Channel 11
Pin 3	Channel 12
Pin 4	Channel 13
Pin 5	Channel 14
Pin 6	Channel 15
Pin 7	Channel 16
Pin 8	Supply
Pin 9	Ground

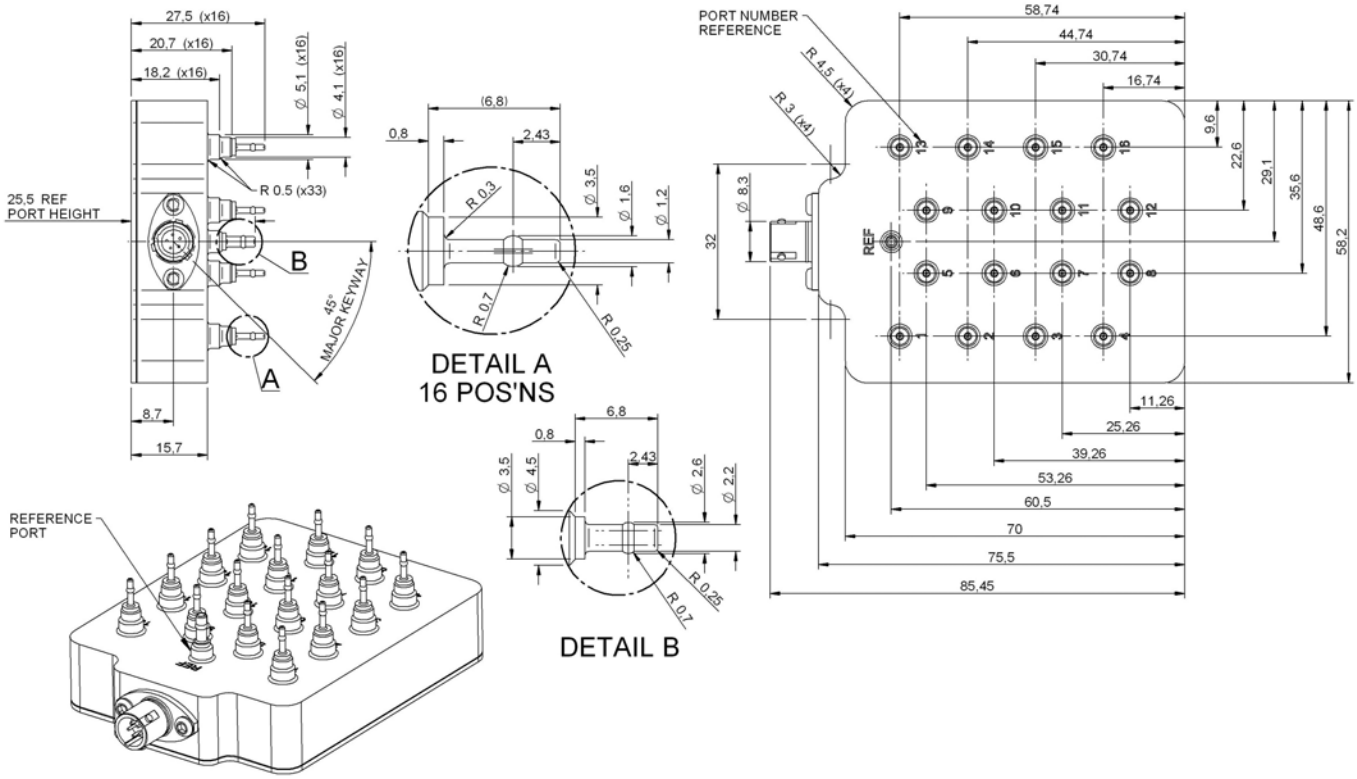
Connection Definition – CAN Variant

- Connector: see ordercode for details

Pin 1	Supply
Pin 2	Ground
Pin 3	CAN +
Pin 4	CAN –
Pin 5	Not connected

Images/Diagrams

O 030 330 005 XXX



Ordercodes

Description	Ordercode
Analogue Output PIN16 Pitot Sensor, 0 to -150 mbar, 0mbar Output @0.5V±0.1V (@25°C), -150mbar Output @4.5V±0.1V (@25°C)	O 030 330 005 048
CAN Output PIN16 Pitot Sensor, 0 to -150 mbar, 0mbar Output @0.5V±0.1V (@25°C), -150mbar Output @4.5V±0.1V (@25°C)	O 030 330 005 028
CAN Output PIN16 Pitot Sensor, STA2-02-05-PN, -172.4 to +172.4 (±2.5PSI) mbar, -172.4 mbar Output @0.5V±0.1V (@25°C), +172.4mbar Output @4.5V±0.1V (@25°C)	O 030 330 005 043
CAN Output PIN16 Pitot Sensor 8STA2-02-05-PA 0 to +344.7 (5PSI) 0mbar +344.7mbar	O 030 330 005 051
CAN Output PIN16 Pitot Sensor 8STA2-02-05-PA -172.4 to +172.4 (±2.5PSI) -172.4mbar +172.4mbar	O 030 330 005 052
CAN Output PIN16 Pitot Sensor 8STA2-02-05-PA -34.5 to +34.5 (±0.5PSI) -34.5mbar +34.5mbar	O 030 330 005 057

Description	Ordercode
CAN Output PIN16 Pitot Sensor 8STA2-02-05-PA 68.95 to -275.8 (+1 to -4PSI) 68.95mbar -275.8mbar	O 030 330 005 058

Pressure (Fluid)

Micro Pressure Sensor Amplified

The miniature amplified pressure sensor has been developed and manufactured exclusively for McLaren Applied Technologies by GE Sensing.

The output voltage of this sensor changes with absolute pressure. An internal amplifier creates a single-ended, amplified output in the 0 to 5 Volt range, so the sensor can be connected directly to most control units. The body and diaphragm are impervious to chemical attack by standard motorsport fluids.

The Pressure connection is also available as M8x1.

Please request our installation datasheet for further details.

In Detail

Electrical

- Supply voltage 8 to 16V unregulated
- Supply current 5mA max
- Maximum output voltage 4.95V
- Span 4.5V ±0.05V @ 25°C
- Extrapolated zero offset 0.2±0.05V @ 25°C
- Thermal shifts

  Sensitivity ±2.5%FSO @ 25°C[1]

  Zero offset ±2.5%FSO @ 25°C[1]

  Combined non-linearity, repeatability & hysteresis ±0.25% FSO @ 25°C BSL
- Insulation resistance >100M? @ 50Vdc
- Gain and offset values are measured at 25°C and will be supplied with the sensor

The sensor is protected against reverse bias or short circuit between output and ground but it may be damaged if the output is connected to the supply.

[1] Over compensated temperature range

Environmental

- Minimum pressure 0 bar

- Max pressure 2 times rated
- Burst pressure 4 times rated
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating Temperature -20 to +175°C
- Compensated temperature 0 to +175°C
- Viton jacketed cable
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Application

- Absolute pressure measurement of all media

Cable and Connection Definition

- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- 26 AWG un-screened cable
- Connection

Red wire	Pin 1	Supply +ve
Black wire	Pin 2	Ground
White wire	Pin 3	Pressure Signal

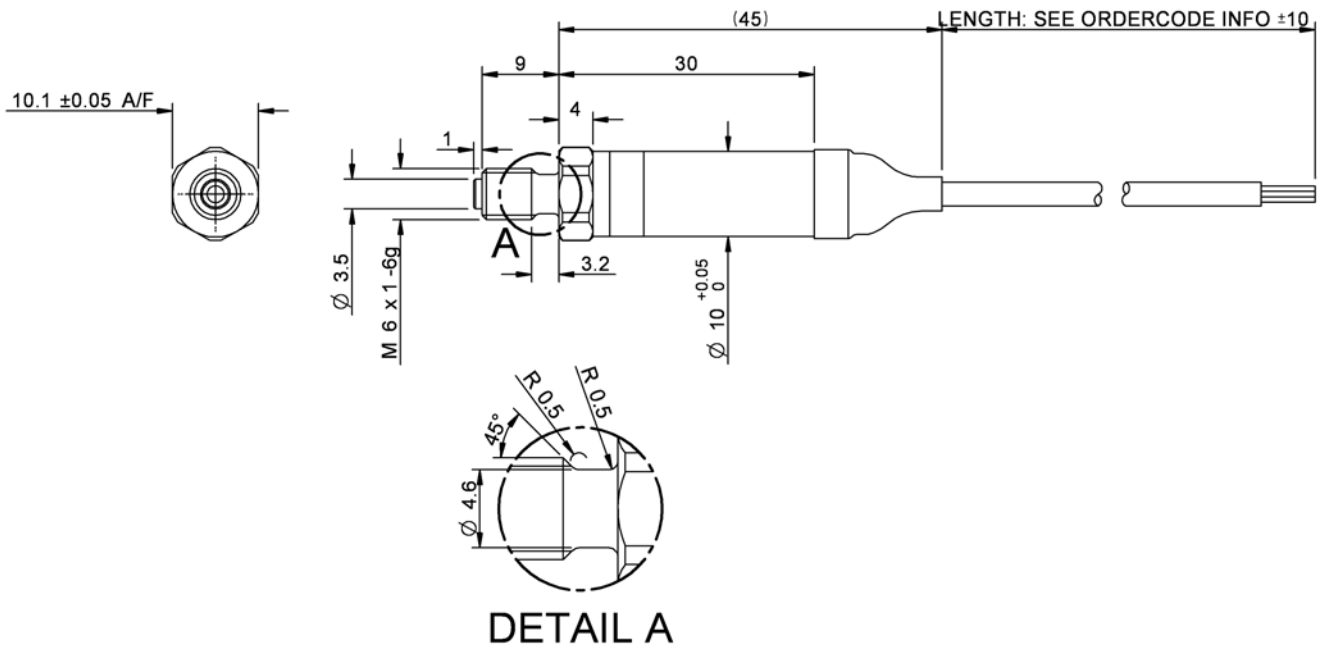
If our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, pressure fittings, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Mecahnical

- Pressure connection also available as M8x1
- Stainless steel body 17-4PH and 316L
- Pressure ranges 5 to 250bar absolute (intermediate ranges available)
- Weight (including cable where fitted) is shown in the order details
- Maximum tightening torque 10Nm

Images/Diagrams

O 030 330 064 XXX



Ordercodes

Description	Ordercode
Micro Pressure Sensor	O 030 330 064 XXX

Mini Pressure Sensor High Temperature Amplified

The output voltage of this sensor changes with absolute pressure. An internal amplifier creates a single-ended, amplified output in the 0 to 5 Volt range, so the sensor can be connected directly to most control units. The body and diaphragm are impervious to chemical attack by standard motorsport fluids.

Please request our installation datasheet for further details.

In Detail

Electrical

- Supply voltage 8 to 16V unregulated
- Supply current 5mA max
- Maximum output voltage 4.95V
- Span 4.5V ±0.05V @ 25°C
- Extrapolated zero offset 0.2±0.05V @ 25°C
- Thermal shifts

  Sensitivity 2.5%FSO @ 25°C (0°C to 175°C)

  Zero offset 2.5%FSO @ 25°C (0°C to 175°C)

  Combined non-linearity, repeatability & hysteresis 0.25 FSO @ 25°C
- Output impedance <100?
- Insulation resistance >100M? @ 50Vdc
- Gain and offset values are measured at 25°C and will be supplied with the sensor

The sensor is protected against reverse bias or short circuit between output and ground but it may be damaged if the output is connected to the supply.

Environmental

- Minimum pressure 0 bar
- Max pressure 2 times rated (up to 375bar max)
- Burst pressure 4 times rated (up to 375bar max)
- Resistant to standard motorsport fluids compatible with Stainless steel 316L
- Maximum humidity 100%

- Operating Temperature -10 to +175°C
- Compensated temperature 0 to +175°C
- DR25 jacketed cable (unless specified otherwise)
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Application

- Absolute pressure measurement of all media

Cable and Connection Definition

- 24 AWG screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection (except where stated otherwise)

Red wire	Pin 1	Supply
Black wire	Pin 2	Ground
White wire	Pin 3	Pressure Signal
N/A	Pin 4	N/C
Screen	Pin 5	N/C

The screen is connected to the sensor body. Either the sensor body or the cable screen should be connected to electrical earth but not both as this may create a ground loop.

If our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, pressure fittings, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

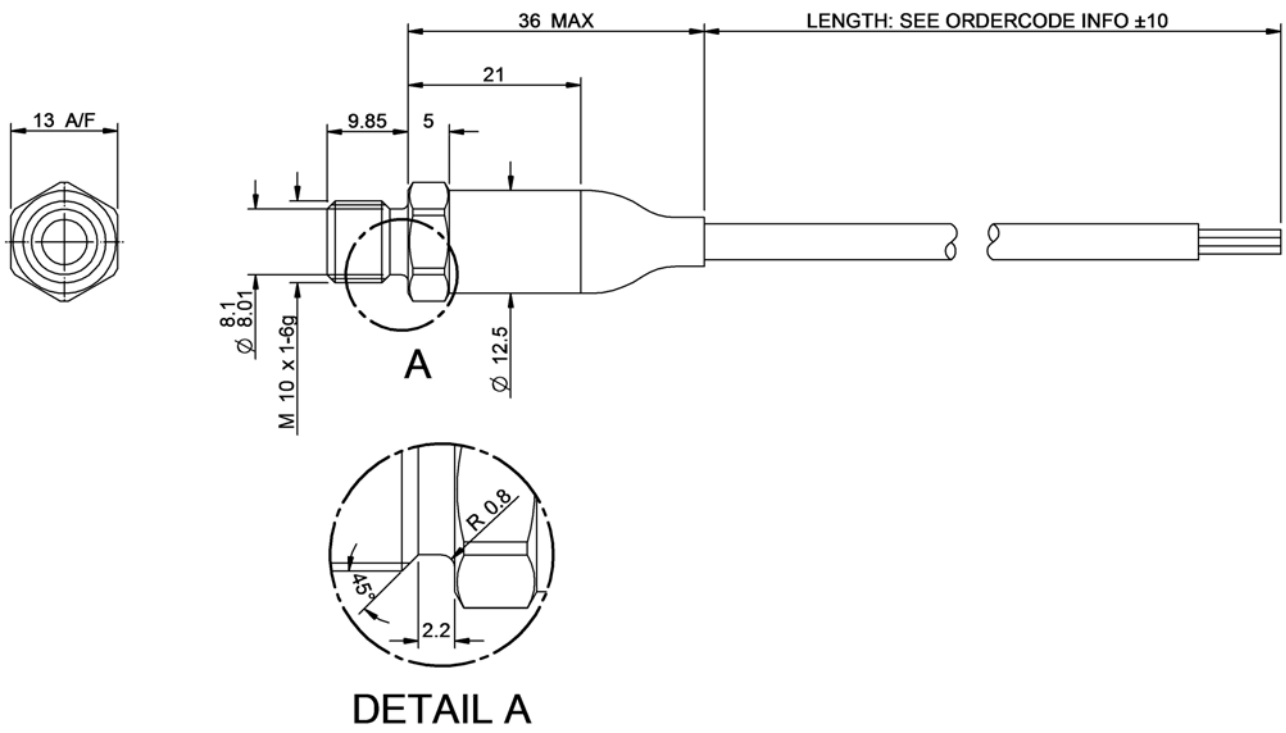
Mechanical

- Stainless steel body
- Pressure ranges 1.6 to 345bar (intermediate ranges available)
- Pressure connection also available as M8x1
- Weight (including cable where fitted) is shown in the order details
- Elastomer boot for strain relief to the sensor body

Images/Diagrams

O 030 330 054 XXX

Stainless Steel - Various pressure ratings (max. 345bar)



Ordercodes

Description	Ordercode
Stainless Steel - Various pressure ratings available (Max. 345bar)	O 030 330 054 XXX

Standard Pressure Sensor High Temperature Amplified

The output voltage of this sensor changes with absolute pressure. An internal amplifier creates a single-ended, amplified output in the 0 to 5 Volt range, so the sensor can be connected directly to most control units. The body and diaphragm are impervious to chemical attack by standard motorsport fluids.

Please request our installation datasheet for further details.

In Detail

Electrical

- Supply voltage 8 to 16V unregulated
- Supply current 5mA max
- Maximum output voltage 4.95V
- Span 4.5V ±0.05V @ 25°C
- Extrapolated zero offset □0.2±0.05V @ 25°C
- Thermal shifts

  Sensitivity □2.5%FSO @ 25°C (0°C to 175°C)

  Zero offset □2.5%FSO @ 25°C (0°C to 175°C)
- Combined non-linearity, repeatability & hysteresis
- □0.1%FSO @ 25°C BSL for ranges up to 60bar

  □0.2%FSO @ 25°C BSL for ranges above 60bar
- Output impedance <100?
- Insulation resistance >100M? @ 50Vdc
- Long term ageing <0.10%FSO/year
- Temperature signal output 2.9V ±0.5V @25°C
- Temperature signal sensitivity 7mV/°C ±1mV/°C
- Gain and offset values are measured at 25°C and will be supplied with the sensor

The sensor is protected against reverse bias or short circuit between output and ground but it may be damaged if the output is connected to the supply.

Environmental

- Minimum pressure 0 bar
- Max pressure 2 times rated (312.5bar max Stainless steel housing, 400bar max Titanium housing)
- Burst pressure 3 times rated (375bar max Stainless steel housing, 500bar max Titanium housing)
- Resistant to standard motorsport fluids compatible with Stainless steel 316L and Titanium IMI 160 (Titanium can be attacked by Methanol and some cleaning fluids)
- Maximum humidity 100%
- Operating Temperature -30 to +175°C
- Compensated temperature -10 to +175°C
- DR25 jacketed cable (unless specified otherwise)
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Application

- Absolute pressure measurement of all media

Cable and Connection Definition

- 24 AWG screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection (except where stated otherwise)

Red wire	Pin A	Pin 1	Supply
Black wire	Pin B	Pin 2	Ground
White wire	Pin C	Pin 3	Pressure Signal
Blue wire	Pin D	Pin 4	Temp. Signal
Screen	Pin E	Pin 5	N/C

The screen is connected to the sensor body. Either the sensor body or the cable screen should be connected to electrical earth but not both as this may create a ground loop.

If our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, pressure fittings, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

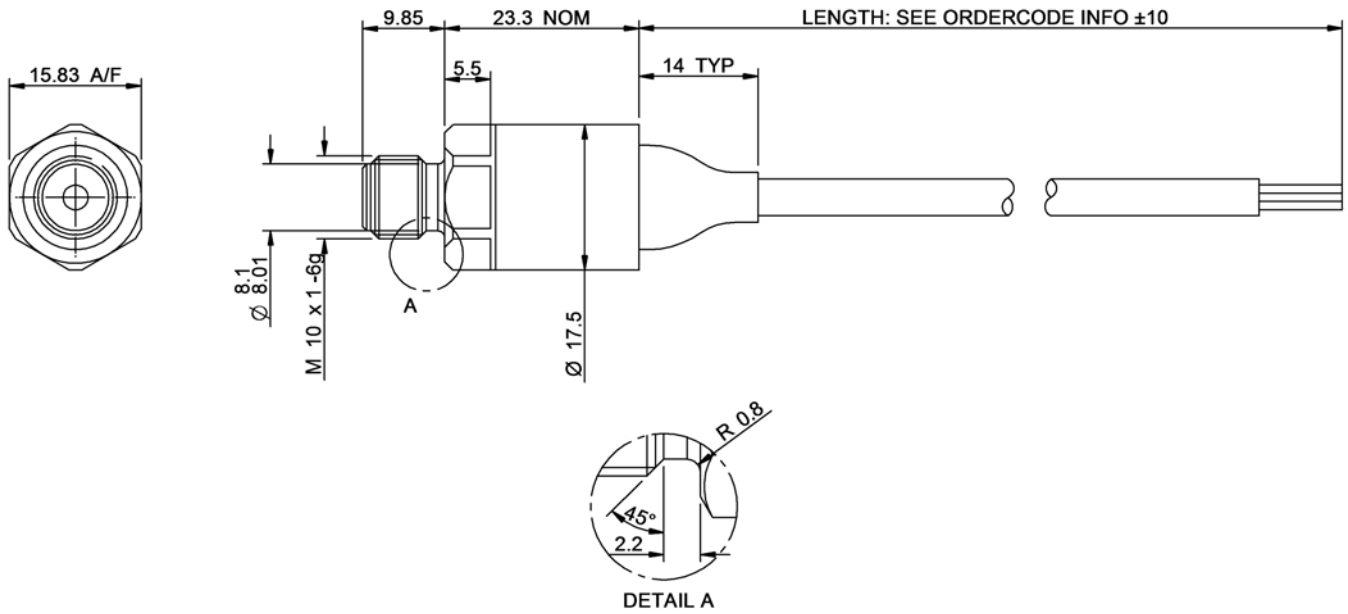
Mechanical

- Titanium or Stainless steel body
- Pressure ranges 1.6 to 250bar (intermediate ranges available)
- Weight (including cable where fitted) is shown in the order details
- Elastomer boot for strain relief to the sensor body

Images/Diagrams

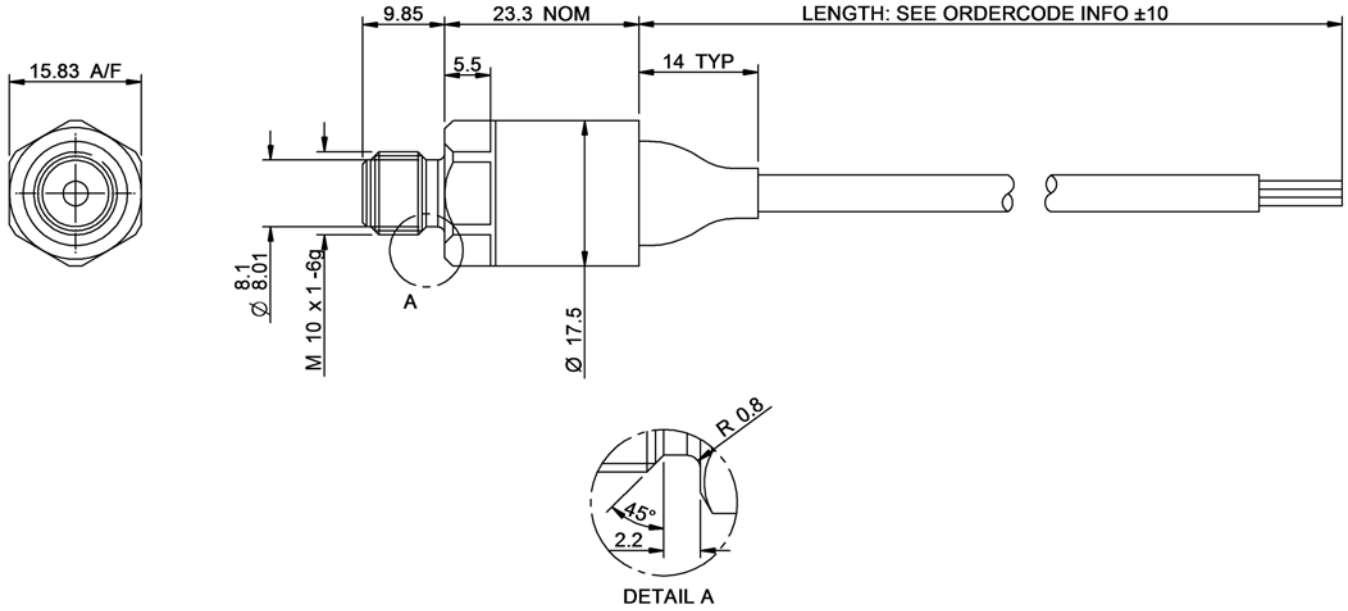
O 030 330 052 XXX

Stainless Steel - Various pressure ratings available (max. 250bar)



O 030 330 059 XXX

Titanium - Various Pressure ratings available (max. 250bar)



Ordercodes

Description	Ordercode
Titanium - Various pressure ratings available (Max. 250bar) <52g	O 030 330 059 XXX
Stainless Steel - Various pressure ratings available (Max. 250bar) <63g	O 030 330 052 XXX

Pressure (Tyre)

Tyre Pressure Monitoring System Corner Recognition

The system consists of a set of battery powered tyre pressure fitted to wheel rims. The sensors communicate with a transceiver, fitted to each corner of the car. The sensor employs low frequency (LF) to receive commands from the transceiver and ultra high frequency (UHF) to transmit sensor data to the transceiver. The Transceiver decodes the data and outputs to the car's ECU via CAN communication. This system features an automatic corner learning function which eliminates the need for pre-assigning corners. The system is easy to install as no central hub for wheel management and external antennas are required.

In Detail

Electrical

Sensor

- Supply voltage 2.2 – 3.0 V (internal lithium battery)
- Transmission rate structured to preserve battery life: Governed by pressure, rate of change of pressure, rotation of the wheel and air temperature in the tyre.
- Transmission count included in transmitted data
- Battery voltage measured on full load

Transciever

- Supply voltage 8 to 16V
- Supply Current TBA
- CAN bus 1Mbps

Tyre Pressure

- Pressure ranges[1] 0 - 116psi (0 - 8.0Bar) gauge
- Pressure resolution 0.228psi (15.7mBar)
- Pressure accuracy, ±0.725 psi (±50mBar) typ, ±1.45 psi (±100mBar) max

Environmental

Sensor

- Resistant to standard Motorsport fluids

- Operating temperature[2] +10 to +125°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Shock 50g(max), 1/2sine for 11ms, 5 times per axis

Transciever

- Resistant to standard Motorsport fluids
- Operating temperature +10 to +85°C
- Vibration 100 to 1000Hz Random Spectrum in each axis

100Hz 0.00395g^2/Hz

200Hz 0.08573g^2/Hz

300Hz 0.27121g^2/Hz

650Hz 0.00482g^2/Hz

1000Hz 0.01039g^2/Hz

Mechanical

Sensor

- Weight <35g
- Sensor lid and housing material – Glass filled Nylon 66

Transciever

- Weight <100g
- Sensor lid and housing material – Glass filled Nylon 66

Board Temperature (Sensor)

- On board temperature sensor
- Temperature accuracy ±3°C typ, ±5°C max

[1]Other pressure ranges are available

[2]Absolute maximum operating temperature +130°C. Operating the sensor above 125°C will reduce the life of the sensor.

[3]The corner ID for the transceiver can also be assigned off car using System Monitor

Connection Definition

Autosport ASX002-05PN HE

Pin no.	Description
1	Vsupply
2	GND
3	CAN-L
4	CAN-H
5	Corner ID Selector

Corner ID is assigned[3] by fitting a resistor across pins 5 and 2 of the mating connector on the car loom

Corner	Resistor (E48 series)
FL	316?
FR	4420?
RL	14700?
RR	61900?

RF Specification

UHF

- Modulation FM (FSK) encoded serial data
- Nominal frequency 433.920 MHz
- Nominal baud rate 20kbps
- Each sensor transmits a unique serial number
- All transmitted data is encoded

RF

- Modulation (ASK) encoded serial data
- Nominal frequency 125 kHz
- Nominal baud rate 3.9kbps

Message content depends on type as follows:

Message Type 1

<Team ID>
<Sensor Number>
<Corner ID>
< Sensor Type>
<Tx Count>
<Message Error>
<Message Type>
<Tx Life>
<Battery Voltage>
<Board Temperature>

Message Type 2

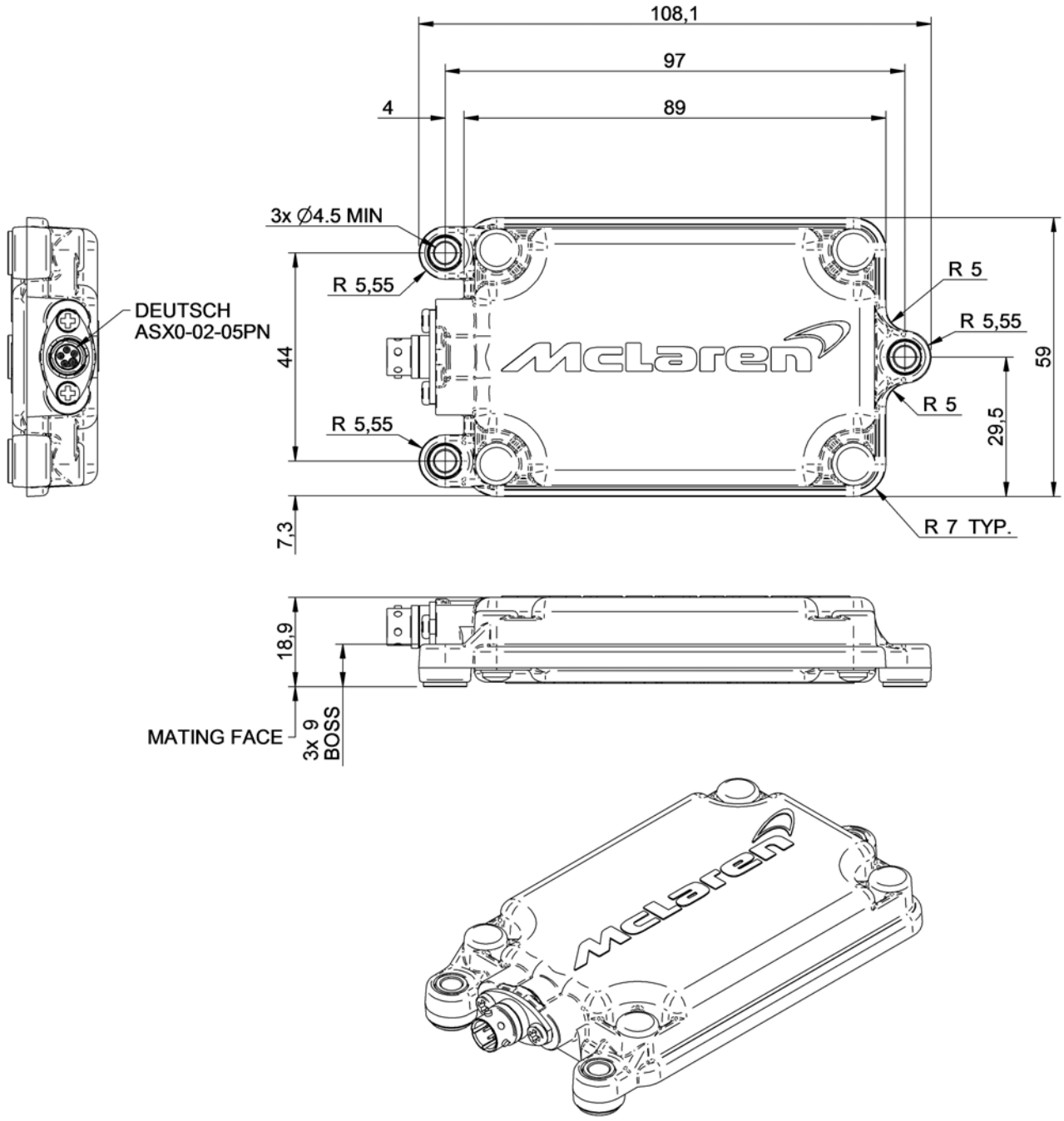
<Team ID>
<Sensor Number>
<Corner ID>
< Sensor Type>
<Tx Count>
<Message Error>
<Message Type>
<Pressure Range>
<Pressure>
<Operation Mode>
<Tx Power>

Tx Rate	*Wheel Rotation*	*Pressure*	*Board Temperature*	*Nominal Threshold dp/dt (mBar/s)*	*Nominal Tx rate, Hz(s)*	*Message type*
0	No	<0.27 Bar gauge	NA	--	0	Samples measurements except IR every 10 seconds. Listens to the LF transceiver once every 2 seconds.
1	No	>0.27 Bar gauge	<40°C		0.0167Hz (60.0s)	Transmits messages 1, 2 cyclically. Samples measurements every 3 seconds. Transmits data every 60 seconds. Listens to the LF transceiver once every 2 seconds.

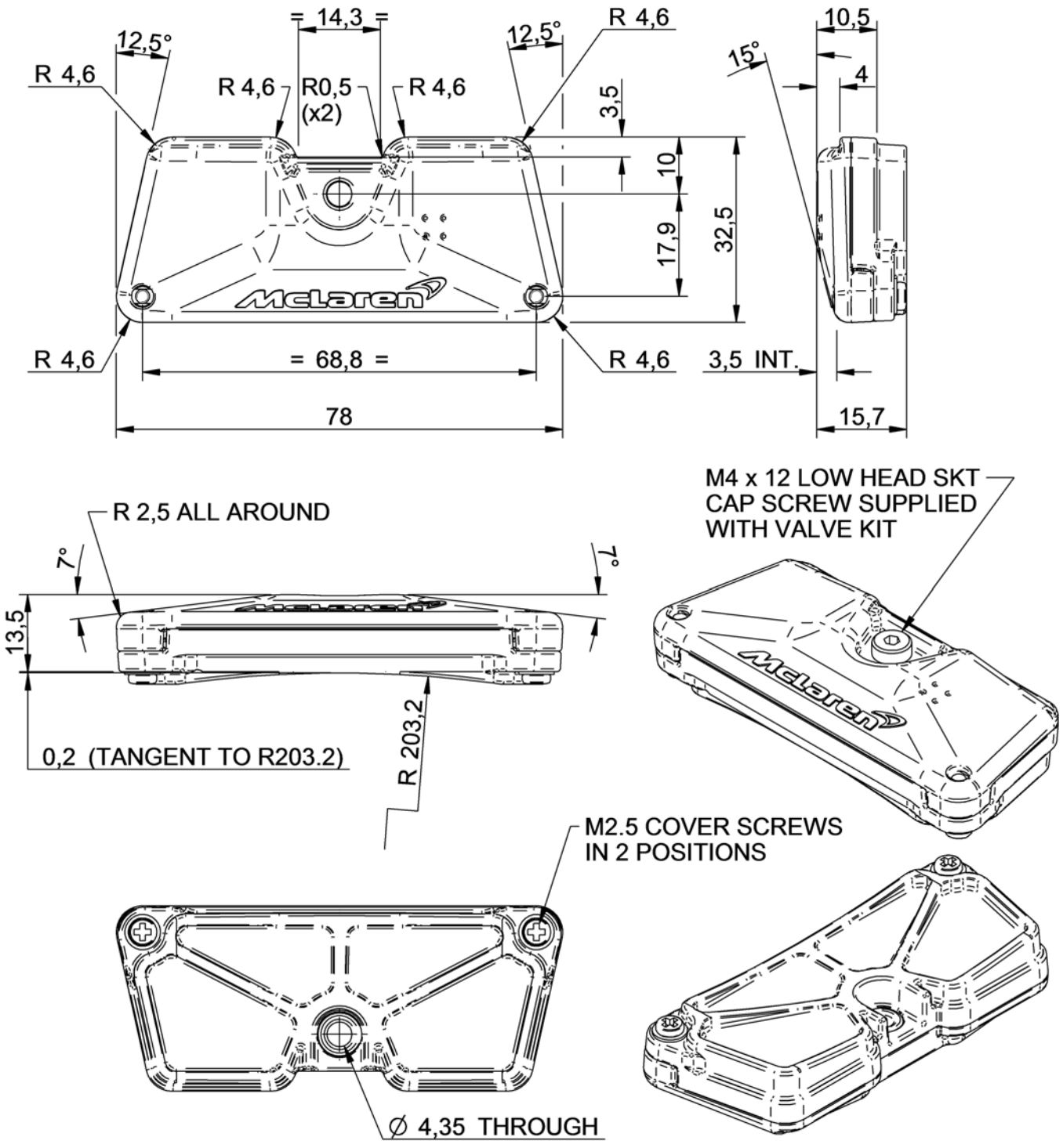
2	No	>0.27 Bar gauge	>40°C		0.083 Hz (12.0s)	Transmits messages 1, 2 cyclically. Samples measurements every 3 seconds. Transmits data every 12 seconds. Listens to the LF transceiver once every 2 seconds.
3	Yes	NA	NA		0.77 Hz (1.3s)	Transmits messages 1, 2 cyclically. Samples measurements every 1.3 seconds. Transmits data every 1.3 seconds. Listens to the LF transceiver once every 2 seconds.
4	NA	>0.27 Bar gauge	NA	TBA	2.0 Hz (0.5s)	Transmits messages 1, 2 cyclically. Samples measurements every 0.5 seconds. Transmits data every 0.5 seconds. Listens to the LF transceiver once every 2 seconds.

Images/Diagrams

O 030 330 068 001



O 030 330 068 000



Ordercodes

Description	Ordercode
Tyre pressure transceiver	O 030 330 068 001
Internal valve mounted tyre pressure sensor	O 030 330 068 000

Tyre Pressure Monitoring System Infra-Red Array

The system consists of a powered pressure and IR temperature array sensor with transmitter fitted to a wheel rim. This sends pressure and temperature data over an RF link to a compact receiver. Sampling rates increase automatically depending on tyre conditions and the sensor will shut down below a threshold pressure to preserve battery life. The receiver sends data to the car control via CAN.

There are two variants of receiver: flying lead version and connector version designed for use on Moto GP super bikes. A single receiver unit is used for receiving data messages from a front and rear tyre sensor.

The sensors and receiver are given a unique team ID number restricting data visibility

In Detail

Electrical

WHEEL SENSOR

- Supply voltage 2.8 – 3.6 V (internal lithium thionyl chloride battery)
- Lifetime> 1,000,000 transmissions
- Transmission count included in transmitted data
- Battery voltage measured on full load
- Transmission rate: Governed by rate of change of pressure, temperature and rotation of the wheel. Structured to preserve battery life.

Tyre Pressure

- Pressure range 0.3 – 7Bar (4.4 – 100psi)
- Pressure resolution 4mBar/bit (0.06psi/bit)
- Pressure accuracy ±10mBar (±0.15psi) typical, ±20mBar (±0.3psi) max
- Self compensated over temperature range

Tyre Temperature (Infra Red (IR) array sensor)

- Object temperature -20°C to +300 °C
- 120° Field of View (FOV)
- 5 tyre temperature points (T1 – T5)

- Temperature resolution 0.078°C/bit
- Temperature accuracy ±3°C
- Repeatability ±1°C

Board Temperature

- On board PTC temperature sensor
- Temperature sensor range -10°C to +190°C
- Temperature resolution 0.17°C/bit

RECIEVER

- Supply voltage 8 to 16Vdc
- Supply current <50mA max at 12Vdc
- Can bus 2.0B active

Mechanical

WHEEL SENSOR

- Sensor weight <50g
- Sensor housing un plated 2014 (HE15) aluminium alloy
- Straight valve/stud kit available separately (ref. drawing sheet 6) which contains:
  6AL4V titanium valve/stud with 1.5mm inlet hole
  Schrader valve core (fitted)
  200-804 Viton O-ring (fitted)
  M6 k-nut (see drawing sheet 6 for recommended torque to sensor body)
  8V1 nut (see drawing sheet 6 for recommended torque to wheel rim)
- Right angled valve/stud kit available separately (ref. drawing sheet 6) which contain
  6AL4V titanium valve/stud with 1.5mm inlet hole
  Schrader valve core (fitted)
  200-804 Viton O-ring (fitted)
  M6 k-nut (see drawing sheet 6 for recommended torque to sensor body)
  Spacer

RECIEVER

- Weight <40g
- Aluminium alloy body, hard anodised and dyed black

Connection Definition

- Cable length 1000mm
- 55 spec 26AWG unscreened cable

Wire colour	Description

Red	Supply
Black	Ground
Blue	CAN+
White	CAN-

- DR-25 jacketed cable
- Antenna connector SMA socket

Case	RF ground
Centre	RF in

Connection Definition (Connector version)

- Connector: Deutsch ASX002-05PN
- Pin designation:

Pin number	Description
Pin 1	Supply
Pin 2	Ground
Pin 3	CAN+
Pin 4	CAN-
Pin 5	Not connected

- Antenna connector SMA socket

Case	RF ground
Centre	RF in

RF Specification

WHEEL SENSOR

- Modulation FM (FSK) encoded serial data
- Nominal frequency 433.920MHz
- Nominal baud rate 71kbps
- Transmission range >5m
- Each sensor transmits a unique serial number
- All transmitted data is encrypted

Message Type 1 (4.704ms duration)

<Team ID>

<Serial Number>

<Sensor Type>

<Message Type>

<Pressure>

<Board Temperature>

<Battery Voltage

<TX Life>

<Acceleration>

Message Type 2 (4.704ms duration)

<Team ID>

<Serial Number>

<Sensor Type>

<Message Type>

<Temperature 1

<Temperature 2>

<Temperature 3>

<Temperature 4>

<Temperature 5>

DESCRIPTION	PRESSURE	BOARD TEMP.	DELTA PRESS.	WHEEL ROTATION	Tx RATE	MESSAGE SEQUENCE
Off Wheel Storage	<0.3Bar	NA	<1.5mBar/s	NO	No Tx	1, 1, 1, ...
Inflated	>0.3Bar	<40°C	<1.5mBar/s	NO	0.016Hz (60s)	1, 1, 1, ...
Inflated & Heated	>0.3Bar	>40°C	<1.5mBar/s	NO	0.010Hz (10s)	1, 1, 1, ...
Pressure Change	NA	NA	>1.5mbar/s	NO	2.0Hz (0.5s)	1, 1, 1, 2, 1, 1, 1, 2, ...
Driving	NA	NA	NA	YES	2.0Hz (0.5s)	1, 2, 1, 2, 1, 2, ...

Before the sensor changes to a lower Tx rate it will continue the transmission during 10 seconds at the higher rate.

Off Wheel Storage: Applies when the pressure is <0.3 Bar gauge. Sensor does not transmit but continues to sample the pressure, accelerometer, battery voltage and board temperature.

Rates quoted are for Vsupply = 3.6V and 25°C. Rates slow down linearly with increasing temperature and reducing Vsupply. Rates are 0.63 quoted values under combined worst case condition of Vsupply = 2.7V and temperature = 135°C.

RECIEVER

- Modulation FM (FSK) encoded serial data
- Nominal frequency 433.920MHz
- Nominal baud rate 71kbps
- Antenna supplied. Can be mounted directly to receiver or connected via coax extension cable

Environmental

WHEEL SENSOR

- Resistant to standard motorsport fluids
- Operating temperature +10 to +135°C
- Vibration 50 to 2500Hz @ 40g, 8 hrs per axis
- Shock 50g per axis, 1/2 sine for 11ms

RECIEVER

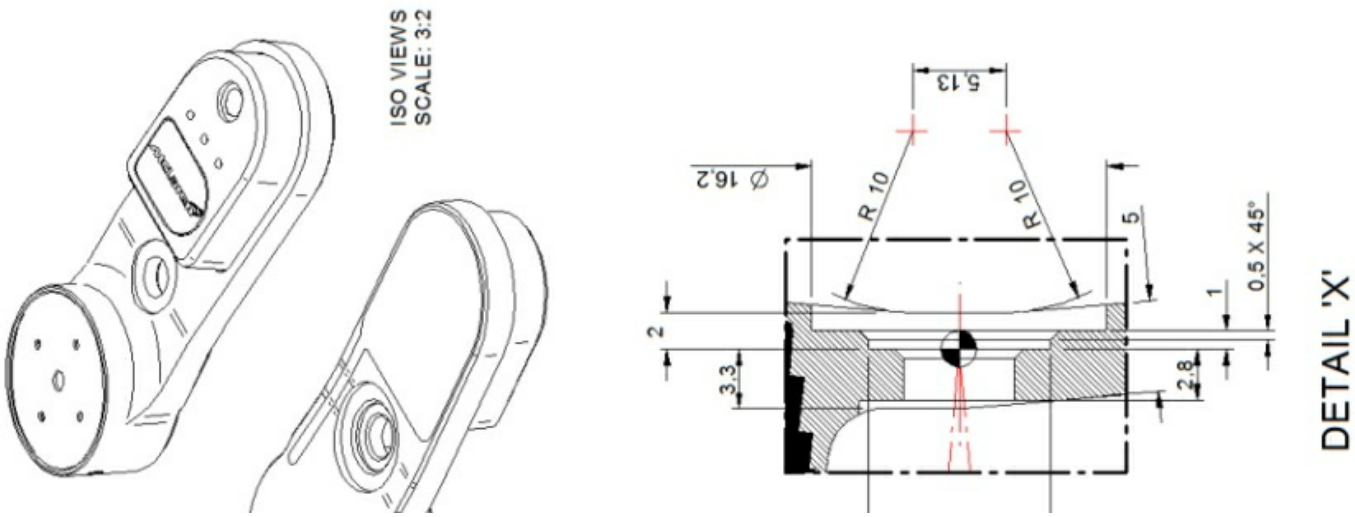
- Resistant to standard motorsport fluids
- Operating temperature +10 to 85°C
- Vibration 100 to 1000Hz random spectrum for 2 hours in connector axis

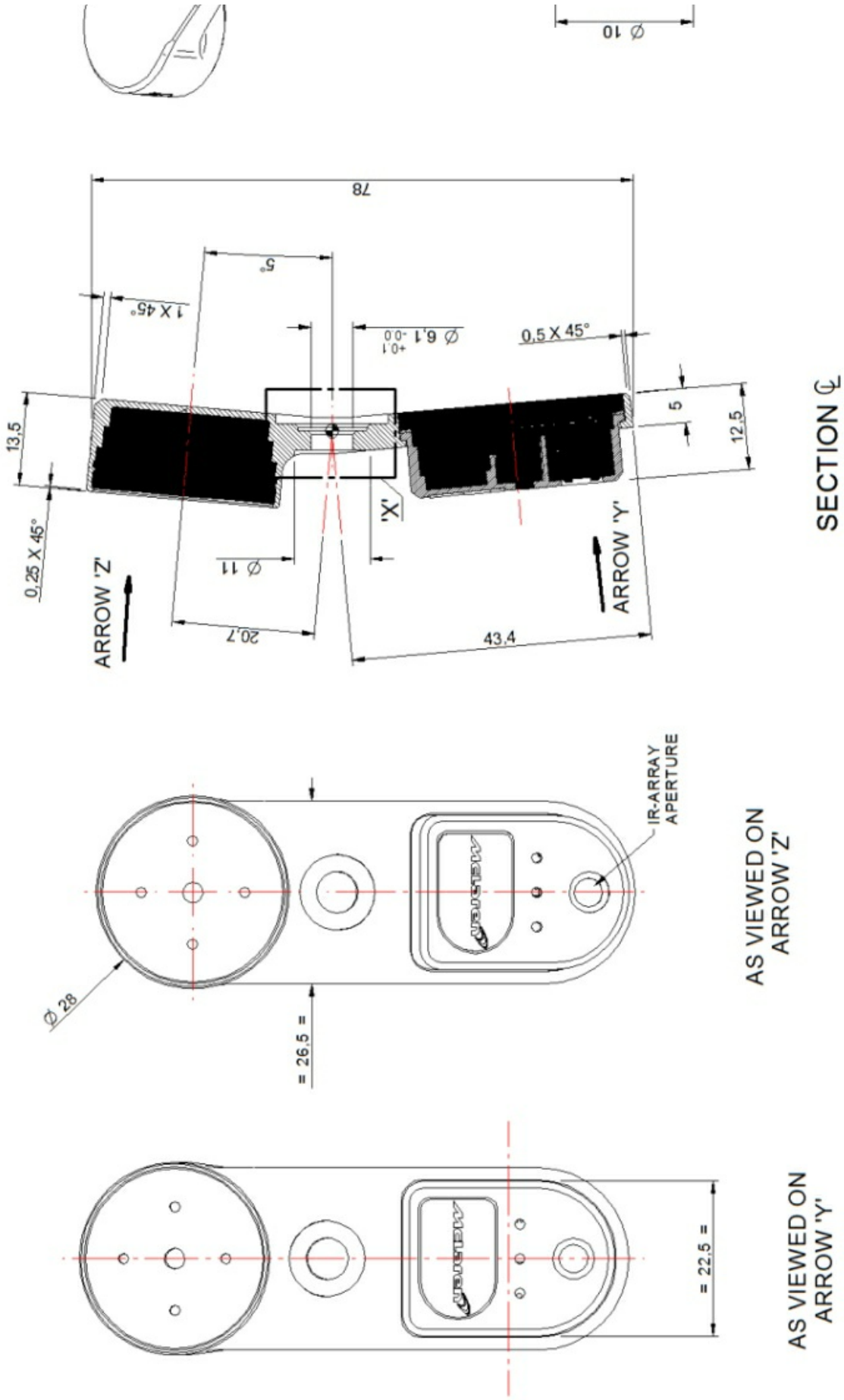
100Hz	0.00395g^2/Hz
200Hz	0.08573g^2/Hz
300Hz	0.27121g^2/Hz
650Hz	0.00482g^2/Hz
1000Hz	0.01039g^2/Hz

Images/Diagrams

Combined Tyre Pressure and Infra Red Array sensor

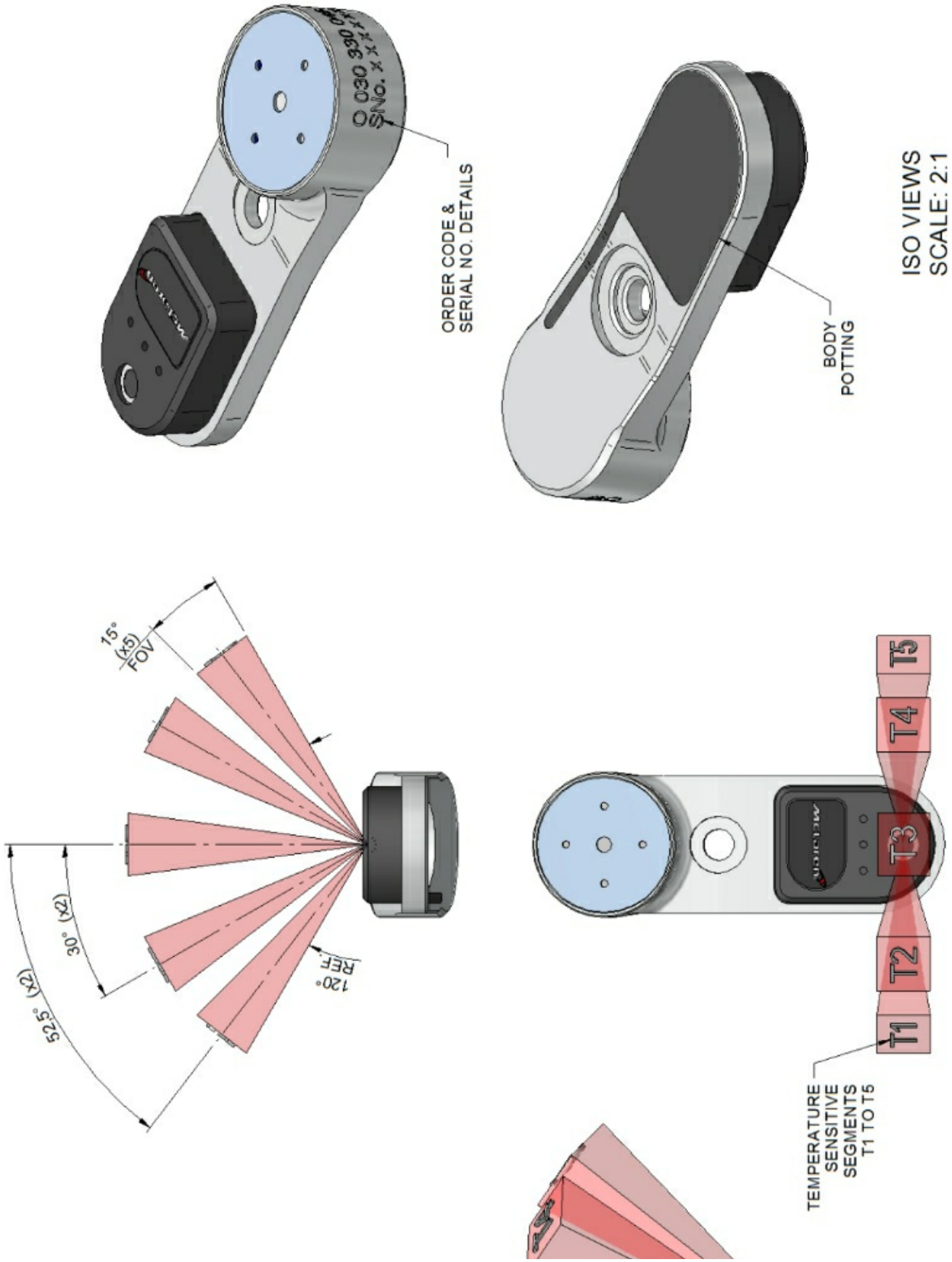
O 030 330 046 110

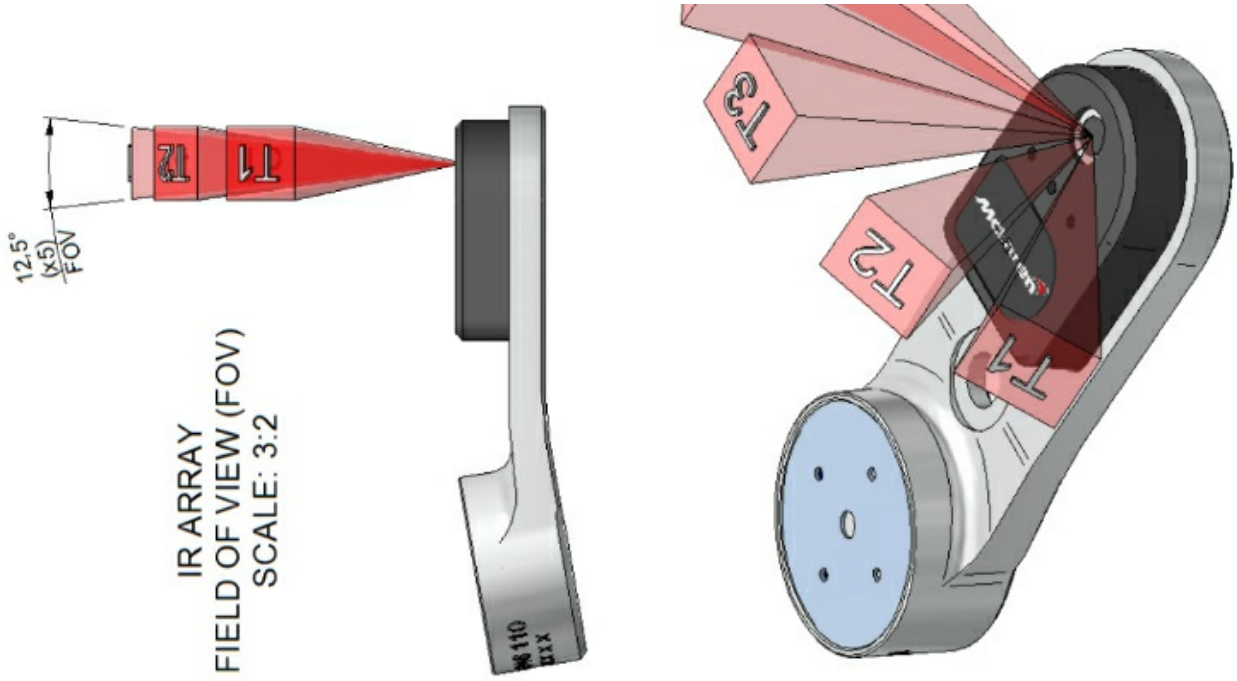



Ø 10
78
5°
1 X 45°
Ø 6,1 +0,1 -0,0
0,5 X 45°
13,5
5
12,5
'X'
0,25 X 45°
ARROW 'Z'
ARROW 'Y'
Ø 11
20,7
43,4
SECTION ℄
IR-ARRAY APERTURE
Ø 28
= 26,5 =
AS VIEWED ON ARROW 'Z'
= 22,5 =
AS VIEWED ON ARROW 'Y'

Combined Tyre Pressure and Infra Red Array sensor

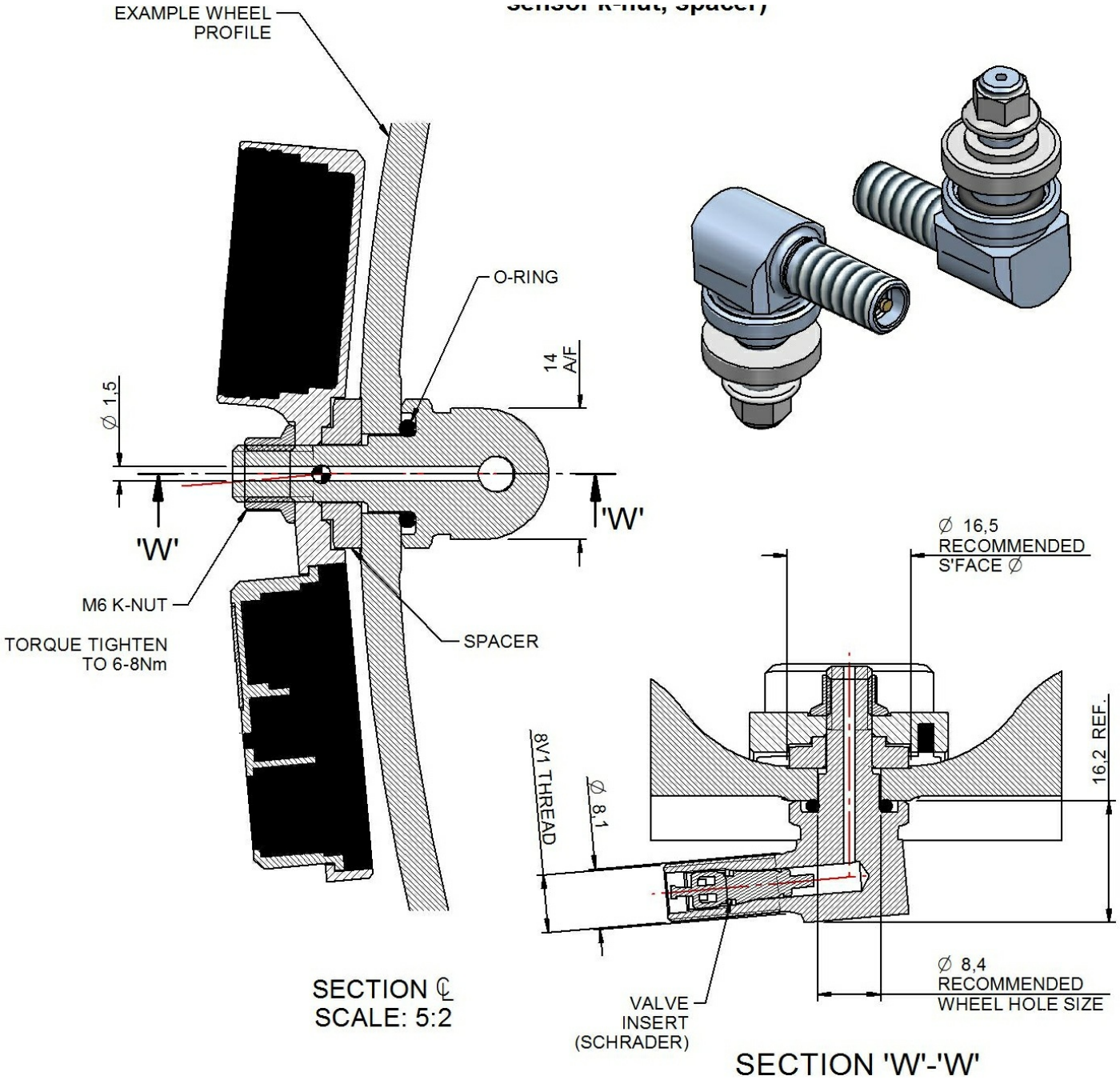
Sensor housing and stud designs can be tailored to suit individual wheel rims. The outline drawings shown within this product summary are examples for which other bespoke designs may be based upon. Pl





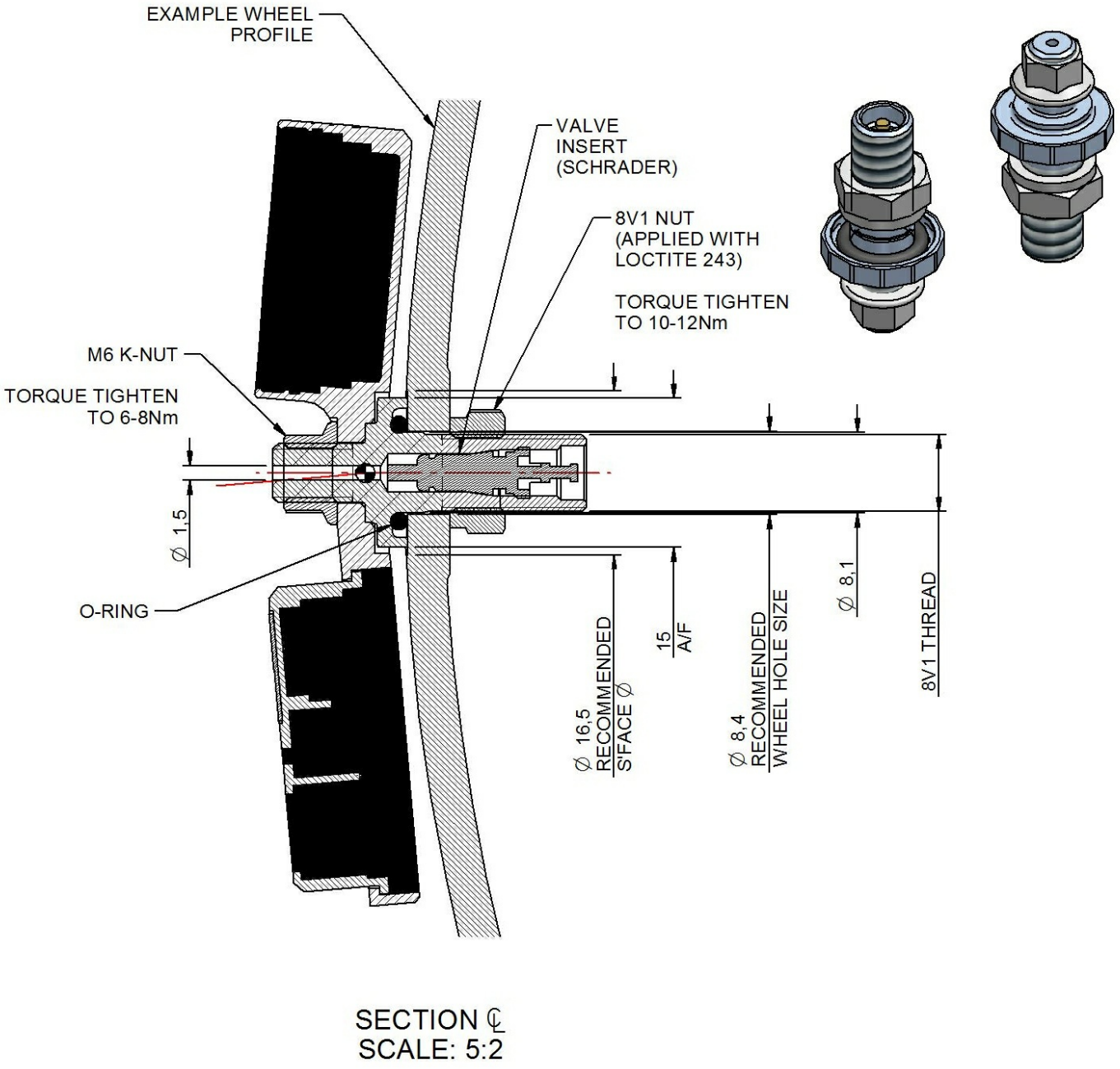
Right Angled Stud Kit

O 030 330 990 075



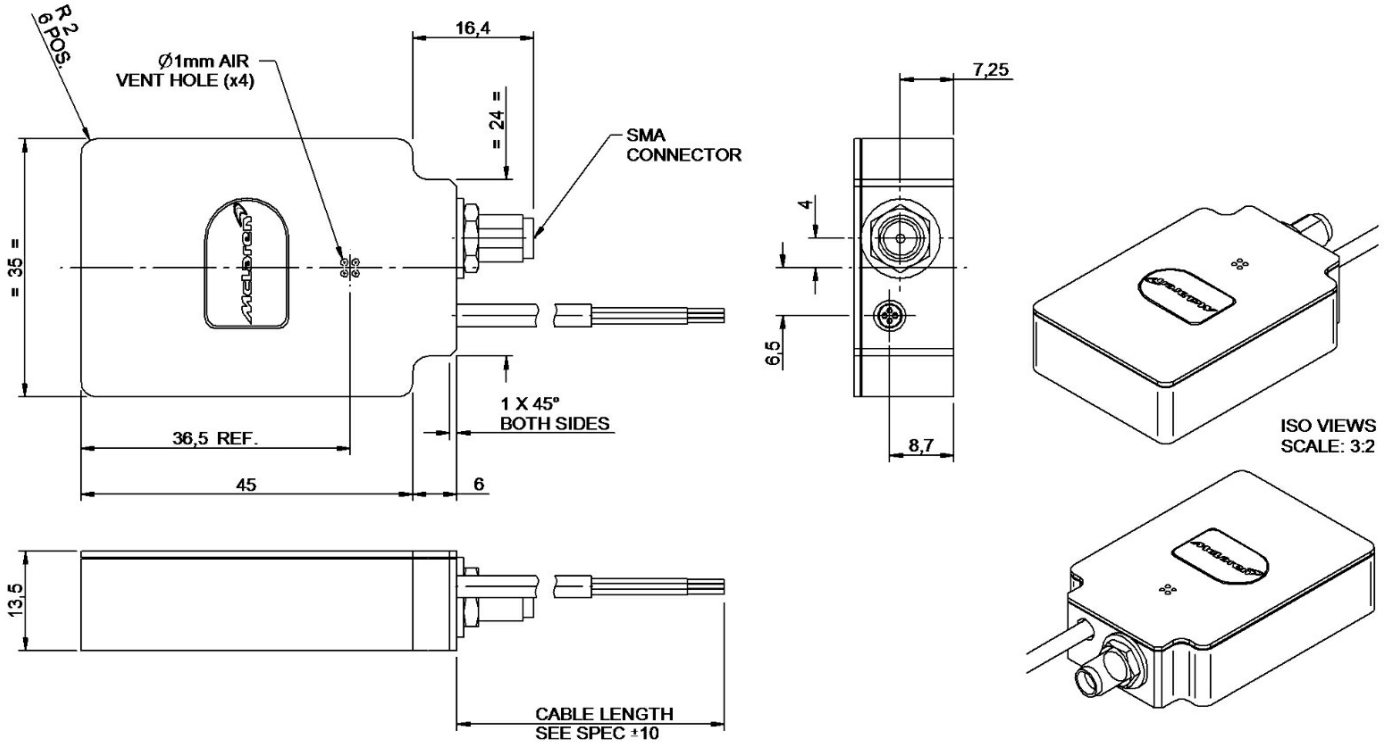
Straight Stud Kit

O 030 330 990 064



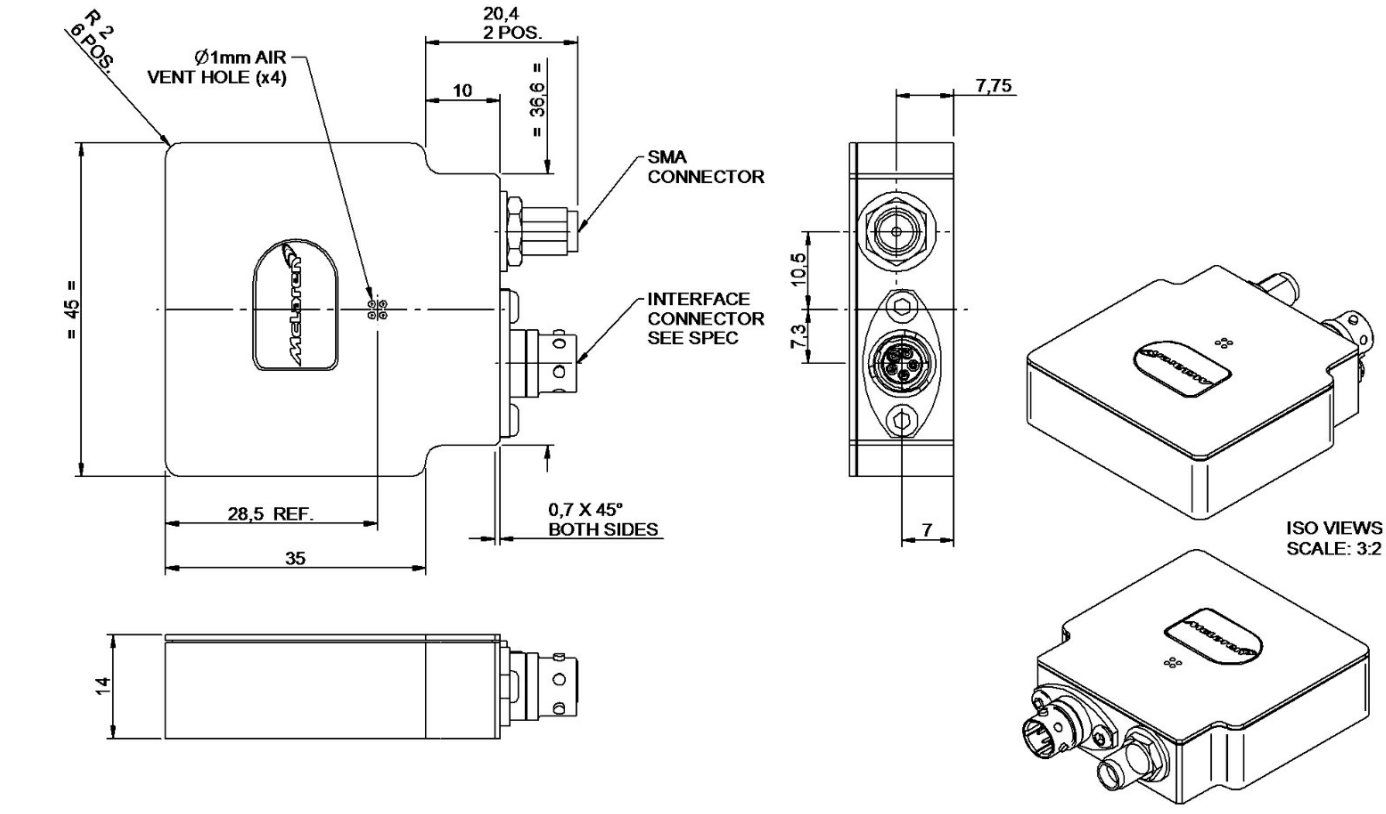
Flying Lead TPTASS Receiver

O 030 330 046 112



Connector Version TPTASS Receiver

O 030 330 046 115



Ordercodes

Description	Ordercode
Connector Version TPTASS Receiver	O 030 330 046 115
Combined Tyre Pressure and Infra Red Array sensor	O 030 330 046 110
Flying Lead TPTASS Receiver	O 030 330 046 112
Straight Stud Kit	O 030 330 990 064
Right Angled Stud Kit	O 030 330 990 075
Receiver Antenna	O 030 330 990 008
Antenna cable assembly (1m)	O 030 330 990 076

Signal Conditioning

EDS Interface Single Channel

The EDS sensor interface unit is to be used with the Micro Epsilon EDS (Eddy Current Displacement) linear stroke sensor. The interface unit provides the excitation voltage for the sensor and converts the signal response into an amplified 0 to 5V output.

In Detail

Electrical

Electrical parameters when connected to EDS-28-G-CA-U-MOOG Actuator Sensor

- Supply voltage 8 to 16V unregulated
- Reverse polarity protection
- Protection from supply transients
- Supply current 62mA max @10V
- Output voltage 0.5 to 4.5V
- Resolution 10-bit
- Temperature Stability 50ppm @ 85°C (Zero & sull Scale)
- Non Linearity 1.5% Typ, 2.5% Max

Connection Definition

- Connector ASDD206-09PN-HE
- Connection details
-

Pin 1	Supply
Pin 2	Ground (supply)
Pin 3	Signal
Pin 4	Signal ground
Pin 5	Sensor connection M
Pin 6	Sensor connection M/K
Pin 7	Sensor connection K
Pin 8	Not Connected

Pin 9	Not Connected

- Sensor cable should be screened and terminated to the shell of the connector.
- Ground return path for the filter capacitors is via the case ground which must be connected to the chassis ground.

Mechanical

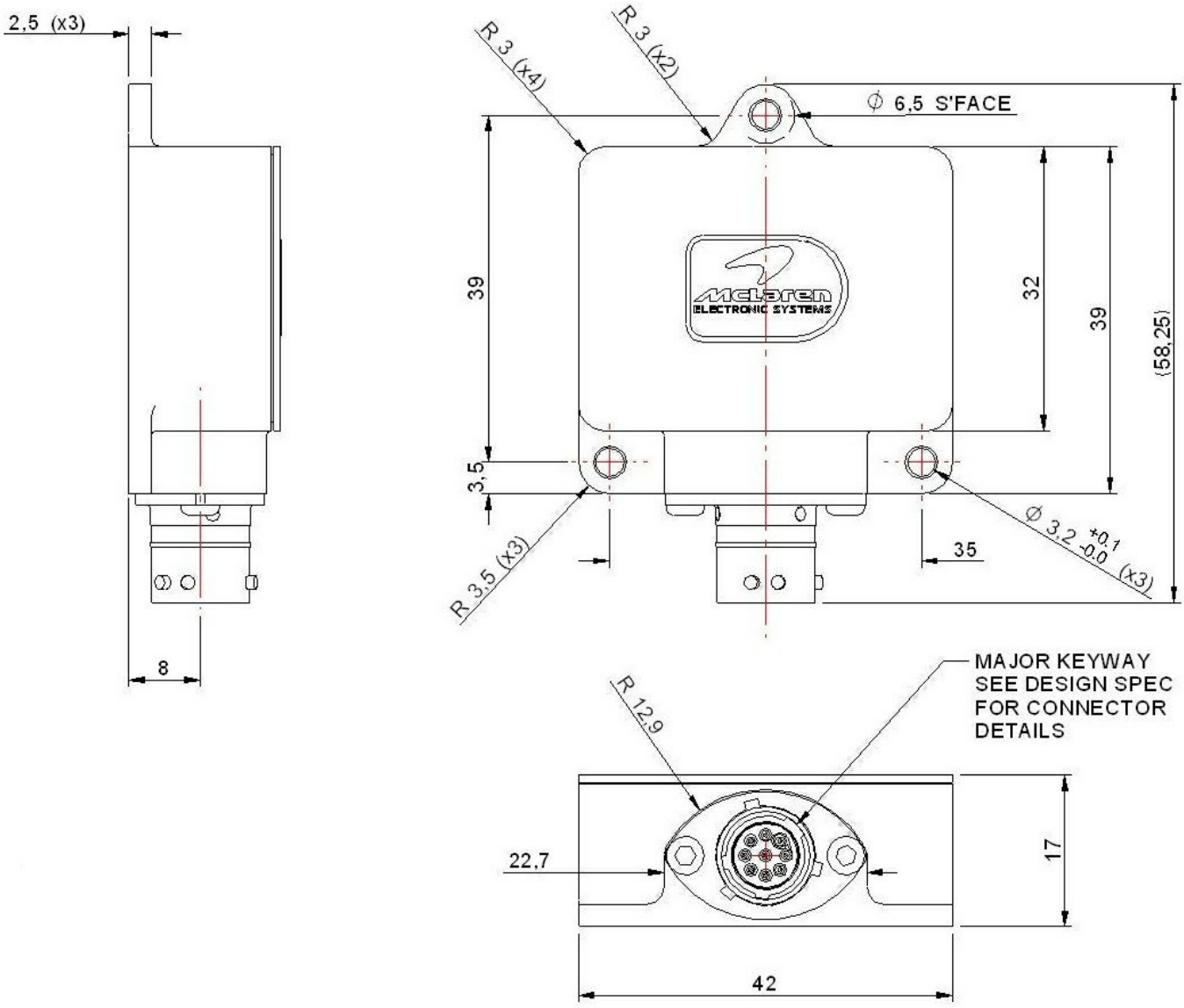
- Weight 55g
- Aluminium alloy body and lid with Alocrom 1200 coatings to Mil-C-5541

Environmental

- Operating temperature 0 to +125°C
- Body resistant to standard motorsport fluids
- Vibration 500 to 2000Hz, 20g Peak acceleration
- Maximum humidity 100%

Images/Diagrams

O 030 320 015 000



Ordercodes

Description	Ordercode
EDS Interface Single Channel	O 030 320 015 000

Inductive Speed Sensor Interface Speed Sensor to TTL

The output of an inductive (magnetic reluctance) speed sensor is an alternating voltage in which both the frequency and magnitude depend on target speed. The TTL Interface Adaptor converts this voltage into a TTL logic signal whose frequency corresponds to tooth passing frequency. The magnitude of the output signal from the interface is independent of the tooth passing speed.

In Detail

Application

- Conversion of inductive sensor output to TTL level logic.

Electrical

- Supply voltage is shown in the order details
- Input voltage threshold is shown in the order details
- Output level TTL compatible
- No load supply current 20mA max
- Maximum output sink current 1mA at 0.8V
- Maximum output source current 100µA at 3.5V

When a rising input voltage exceeds the upper threshold, the output goes from high to low. When a falling input voltage becomes less than the lower threshold, the output goes from low to high.

Cable and Connection Definition

- 22 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Input Connection
-

White Wire	Pin A	Pin 1	Sensor Signal +
Black Wire	Pin B	Pin 2	Sensor Signal -

- Output Connection
-

Red Wire	Pin A	Pin 1	Supply
White Wire	Pin B	Pin 2	Output Signal
Green Wire	Pin C	Pin 3	Ground

Mechanical

- Weight less than 45g including cable
- Body material polyester
- Polyester cable boss for strain relief to the interface body

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Any of our inductive speed sensors can be supplied with this interface already fitted. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -30 to 85°C
- Viton jacketed cable
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Ordercodes

Description	Ordercode
	O 030 200 006 005
	O 030 200 006 007

LVDT Interface Unit LIU-4

The LIU-4 provides signal conditioning for four five-wire LVDT positioning sensors. When the LVDT sensors are being used in latency critical control systems, the conditioned signals are passed to the host ECU as four 0 to 5V analogue outputs. Where LVDT sensors are used for diagnostics or where control system speed is less critical, the signal conditioned values can be made available over the CAN bus communications link in order to reduce system harnessing.

A common primary sine wave signal is generated to supply all four LVDT sensors. This prevents beat notes being generated due to stray magnetic coupling when the LVDT sensors are used in close proximity using similar frequencies. The frequency and amplitude of the common primary signal are software programmable. The primary signal to each LVDT is individually buffered such that an overload on one sensor primary does not affect the other.

The four 0 to 5V LVDT signal conditioned analogue outputs are individually software programmable for gain and offset in order to provide more flexibility for the measurement span. LVDT sensor open circuit diagnostics are available through the CAN bus communications link

In Detail

Application

- LVDT sensor signal conditioning

Features

- Four five-wire LVDT inputs with ratiometric measurement
- Common primary signal, software adjustable frequency between 1kHz to 15kHz, and voltage between 0.5Vrms to 3.0Vrms. Maximum output current 20mArms.
- Software adjustable gain and offset for each signal conditioned output
- Secondary signal input range 1Vrms to 3.5Vrms
- CAN Bus address ID analogue input
- Unit reset input – switch to ground
- Four 0 to 5V LVDT signal conditioned analogue outputs, with separate reference ground input
- Internal 16-bit micro controller, 12-bit resolution ADC, Flash program memory
- LVDT sensor open circuit diagnostics, unit internal diagnostics including internal temperature
- CAN Bus interface, 1Mbaud standard

Electro Magnetic Compatibility

- Complies with the essential protection requirements of EMC Directive 204/108/EC

Mechanical

- Case material hard anodised aluminium
- Estimated weight 105g

Connection Definition

- Integral, sealed, Deutsch high density Autosport series connectors
-

LVDT connector	23-way	ASDD210-23PN
Main connector	11-way	ASDD208-11PN

Electrical

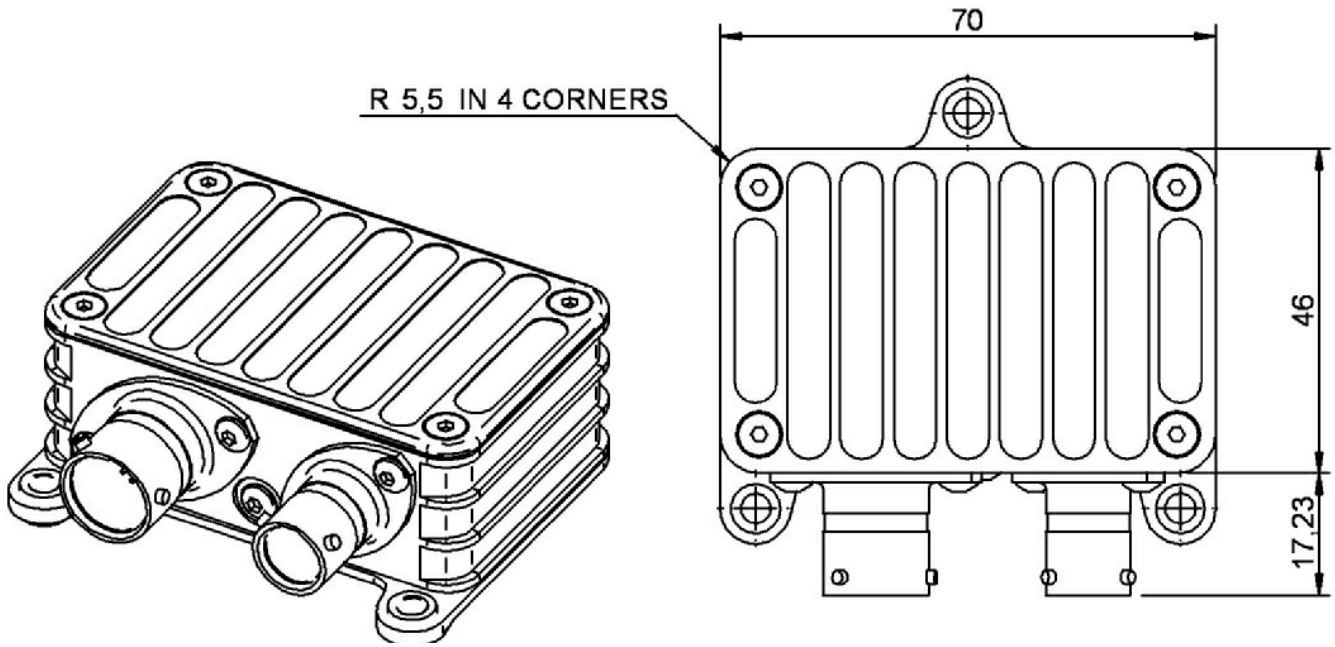
- Supply Voltage 7.5V to 16V DC
- Supply Voltage not to exceed 17V continuous (the unit is protected against transients and reverse polarity)
- Current 180mA typical at 13.8V (with 10mArms LVDT primary loads)

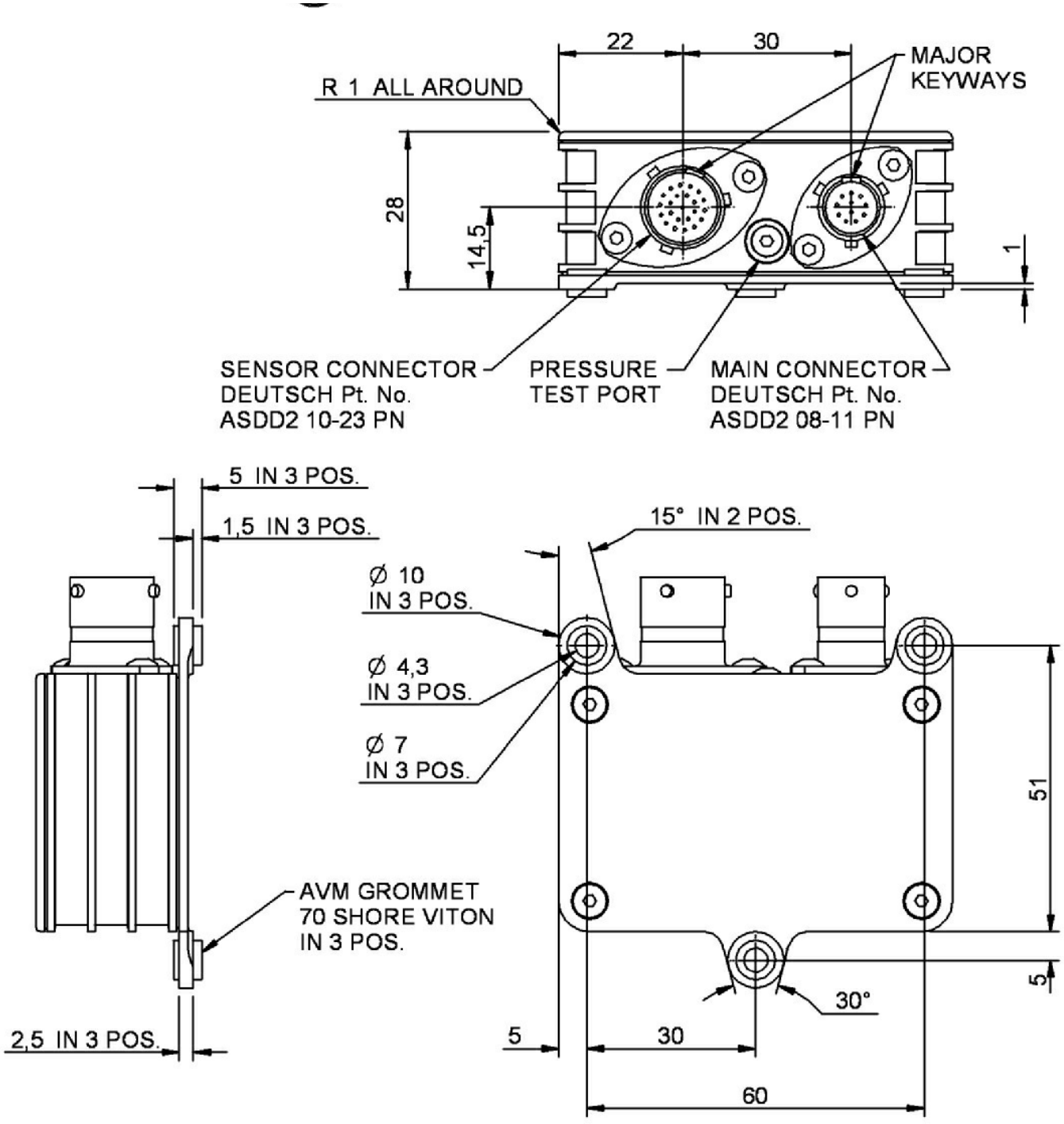
Environmental

- Splash resistant to standard motorsport fluids
- Lids o-ring sealed, screws sealed with silicone sealant
- Maximum humidity 100%
- Minimum operating temperature 0°C
- Internal temperature not to exceed 85°C as measured by internal diagnostic sensor
- Storage temperature -10°C to 85°C
- Vibration 10 to 2000Hz, all axes, 24 hours

Images/Diagrams

O 030 110 012 000





Ordercodes

Description	Ordercode
LIU-4	O 030 110 012 000

Speed

DHE Speed Sensor Differential Hall Effect

DHE (Differential Hall Effect) sensors give an output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). To improve noise resistance, the sensor has two Hall effect elements and only responds to changes in magnetic field strength corresponding to tooth passing frequencies above 15Hz. As each tooth passes the sensor, the digital state of the output changes.

Please request our installation datasheet for further details.

In Detail

Electrical

- Supply voltage 9 to 15V unregulated
- Supply current 5 to 15mA
- Open collector output
- Output current 35mA maximum
- Frequency response 15Hz to 20kHz
- Reverse polarity protection
- Output polarity depends on the rotational direction of the target wheel

Cable and Connection Definition

- 22 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection

Red wire Green wire White wire	Pin A Pin B Pin C	Pin 1 Pin 2 Pin 3	Supply Signal Ground

A 2kohm “pull up” resistor can be included on some models (see Application note)

Mechanical

- Air gap 1.5mm maximum

- Body diameter 9.5 - 11.8mm
- Weight less than 30g (including cable)
- Aluminium alloy body, hard anodised and dyed black
- Polyester cable boss for strain relief to the sensor body

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -10 to +175°C*
- Viton jacketed cable

* Functional life of no less than 1000 hours at 175°C

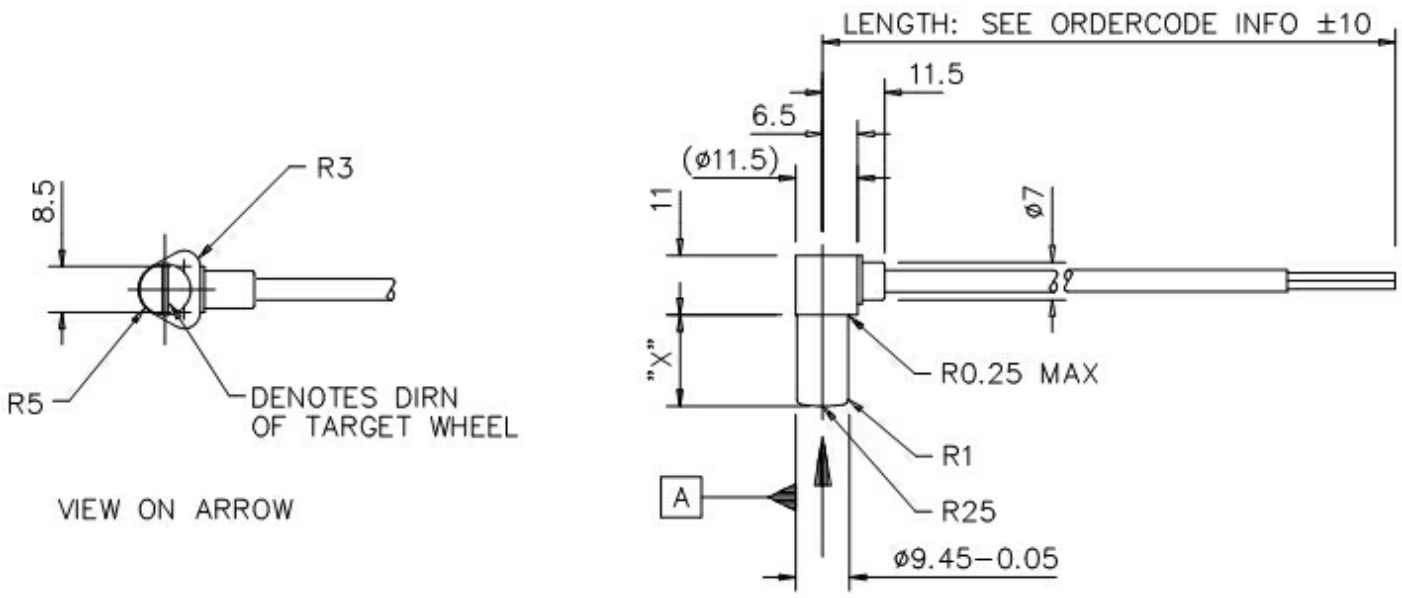
Application

- Wheel speed
- Cam position sensing (application specific, please contact our technical consultancy service)

Images/Diagrams

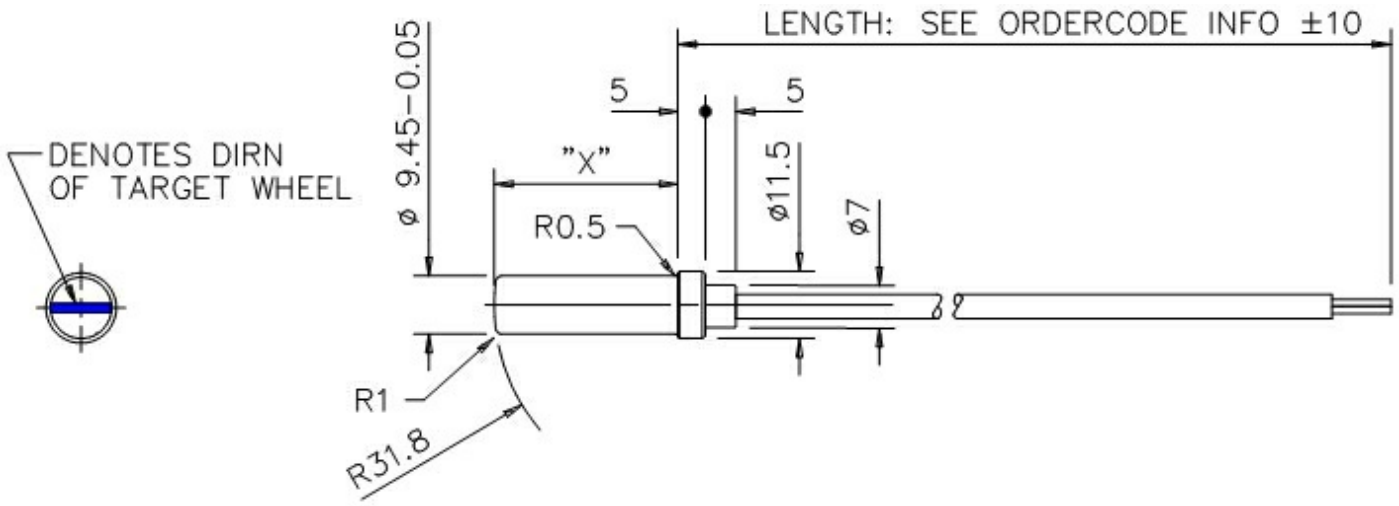
9mm Diameter DHE Speed Sensor - Dimension X = 17mm

O 030 350 000 096



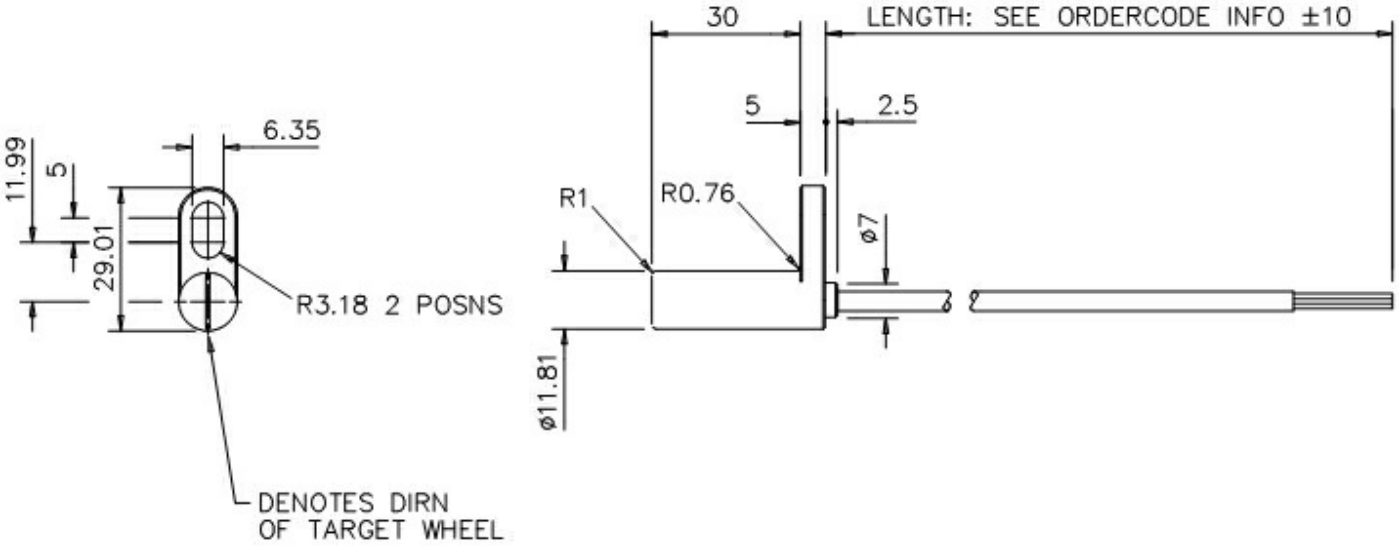
9mm Diamter DHE Speed Sensor - Dimension X = 30mm

O 030 350 000 077



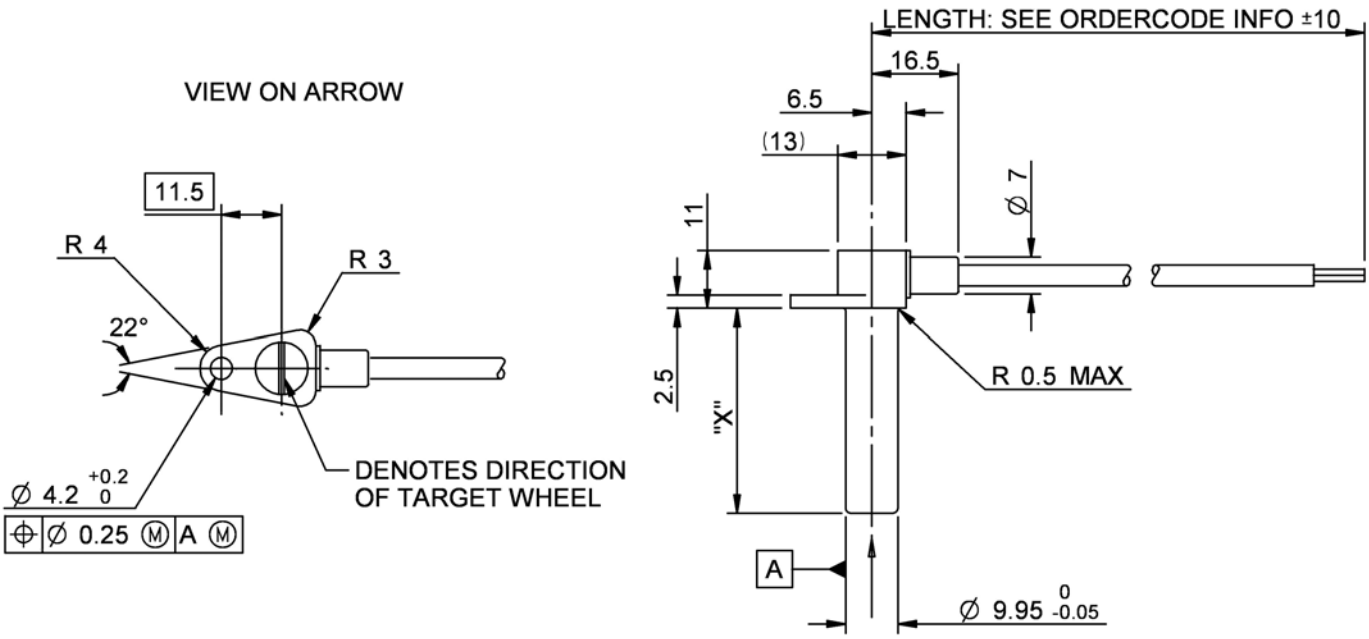
11.8mm Diameter DHE Speed Sensor

O 030 350 000 123



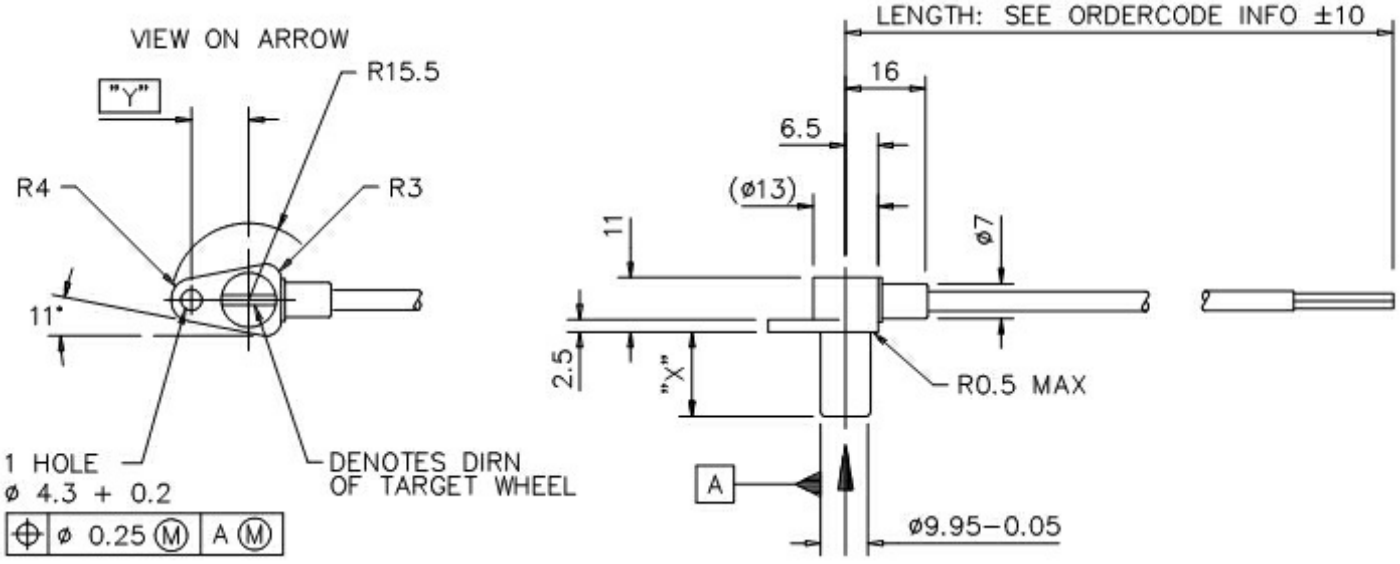
10mm Diameter DHE Speed Sensor - Dimension X = 39mm

O 030 350 000 111



10mm Diameter DHE Speed Sensor - Dimension X = 17mm

O 030 350 000 141



Inductive Speed Sensor Speed Sensor

Inductive sensors give a voltage output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). The voltage increases with increasing speed and with a reduction of the gap between the sensor and the target. The sensors are suitable for use with interfaces that trigger on threshold or zero crossing. Three different body styles are available: 1) totally closed; 2) eddy current reduction slot for increased sensitivity; 3) exposed core and eddy current reduction slot for maximum sensitivity.

Please request our installation datasheet for further details.

In Detail

Application

- Cam shaft, crank shaft and gear speed and position sensing. Wheel speed sensing.

Electrical

- Resistance 510 to 630 ohm
- Cut-in speed is shown in the order details
- Cut-in speed is defined as the speed to achieve 400mV pk-pk @ 0.8mm air gap, with a 120mm diameter target wheel (3kohm load and no load values are given)
- Output polarity follows tooth form, that is a rising metal edge on the wheel generates a rising voltage output from the sensor

Cable and Connection Definition

- 22 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection:
-

White wire	Pin A	Pin 1	Signal +
Black wire	Pin B	Pin 2	Signal -

Mechanical

- Air gap 1.0mm (max), 0.8mm (nominal)
- Body diameter 8mm
- Weight less than 25g (including cable)
- Aluminium alloy body, hard anodised and dyed black
- Polyester cable boss for strain relief to the sensor body
- Sensor is axi-symmetric, special orientation is not required

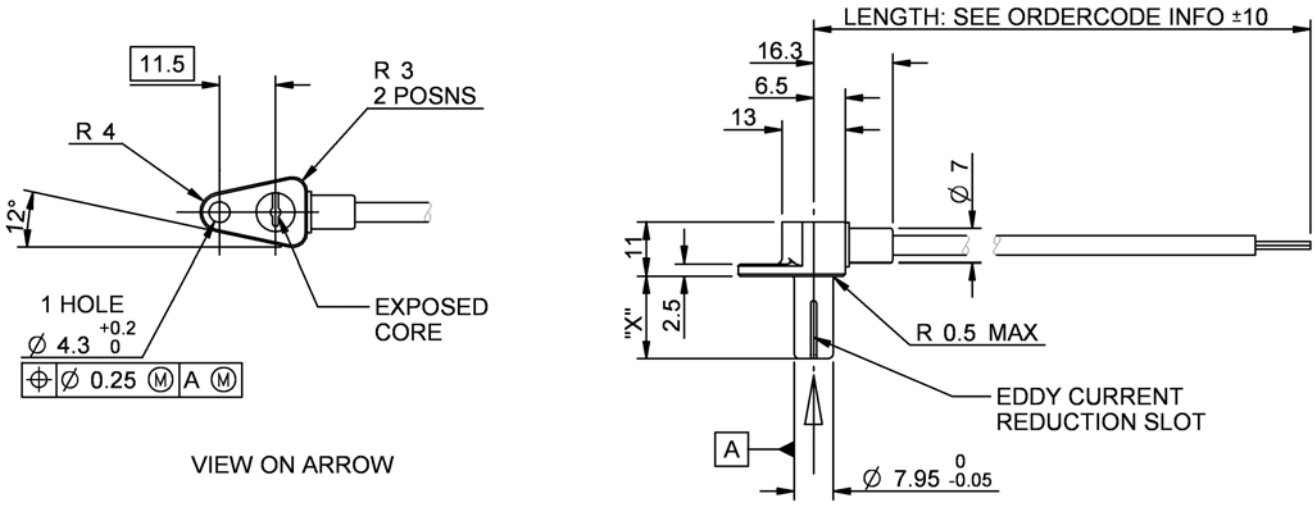
Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Sensor housing and element operating temperature -10°C to + 200°C
- Cable boss maximum operating temperature 150°C
- Viton jacketed cable maximum operating temperature 200°C

Images/Diagrams

O 030 350 001 127



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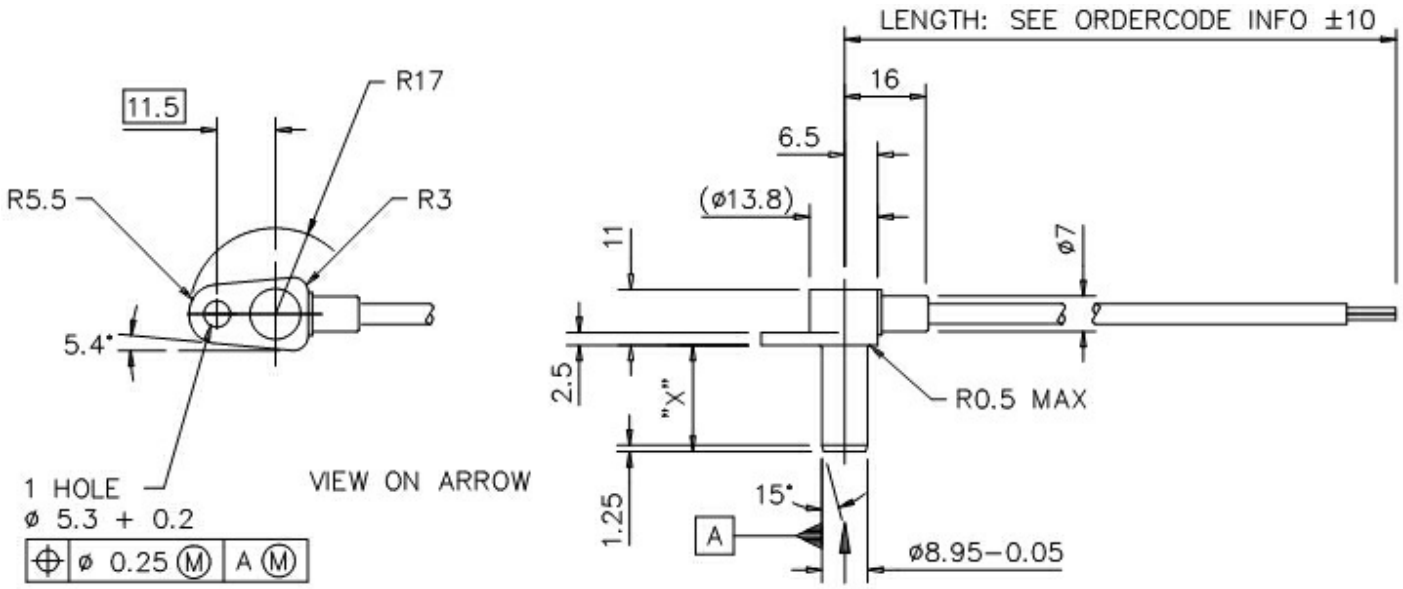

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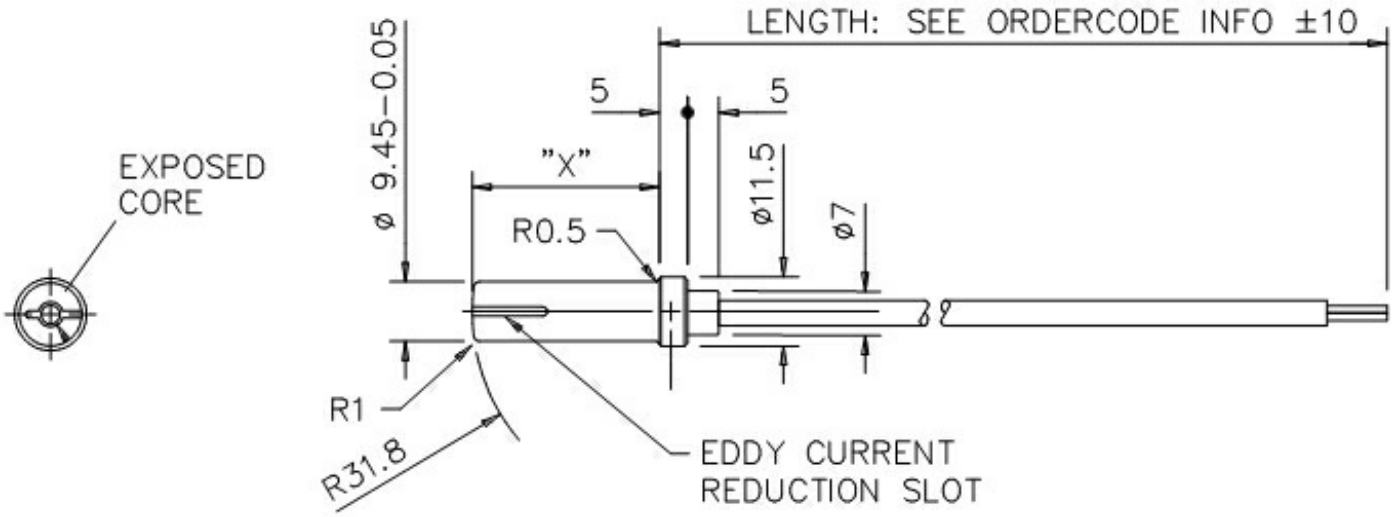
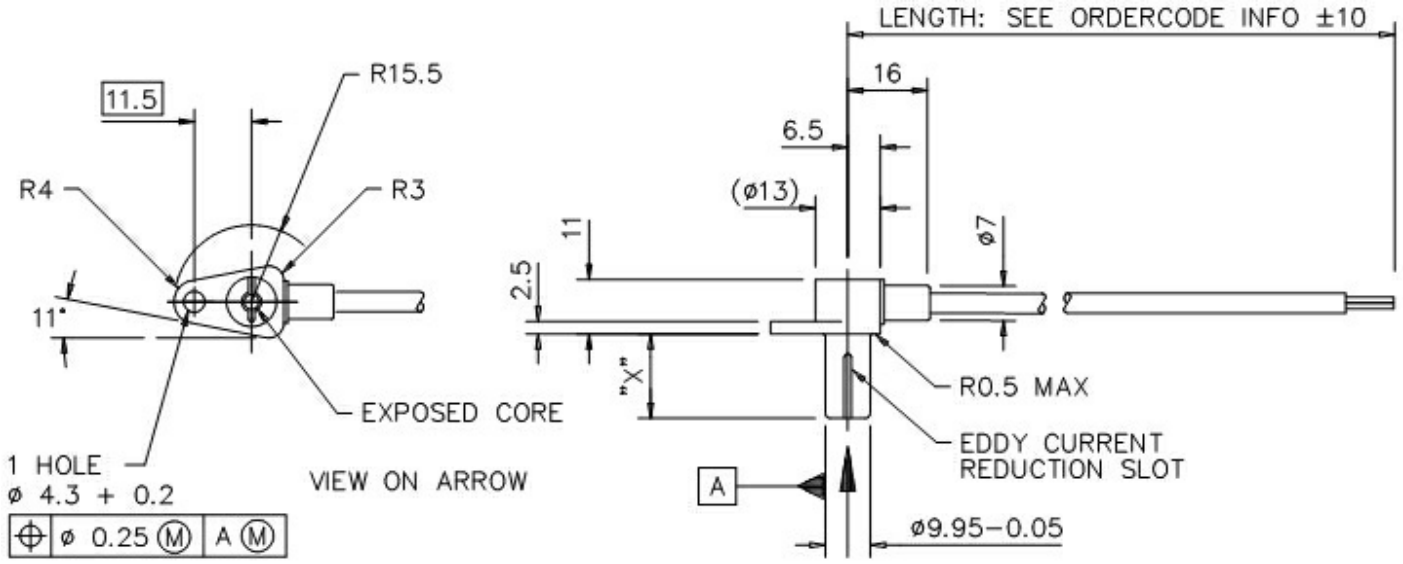
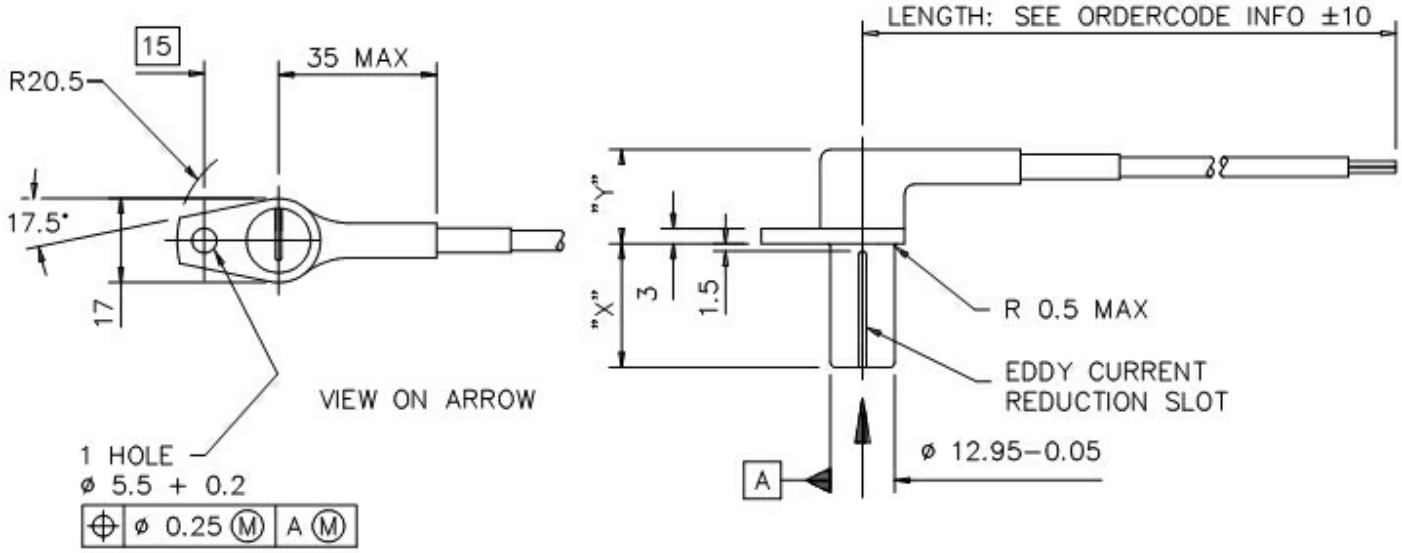


O 030 350 001 075



O 030 350 001 006



Ordercodes

Description	Ordercode
8mm Diameter	O 030 350 001 127
9mm Diameter	O 030 350 001 130
9.5mm Diameter	O 030 350 001 082
10mm Diameter	O 030 350 001 075
13mm Diameter	O 030 350 001 006

Zero Speed Sensor True Position

The True Position/Zero Speed sensor incorporates a DHE (Differential Hall Effect) sensor. The Hall effect gives an output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). The sensor responds to changes in magnetic field strength by corresponding to tooth frequencies down to 0Hz.

In Detail

Electrical

- Supply voltage 9.5V to 12.5V unregulated
- Supply current <20mA
- Open collector output
- Output current 35mA maximum
- Frequency response 0Hz to 12kHz
- Reverse polarity protection
- Output polarity (referring to the target wheel direction and sensor orientation shown on the outline drawing) - the output of the sensor will fall when the sensor is over the centre of a gap and rise when the sensor is over the centre of a tooth
- Positive duty cycle 35 to 65%
- Duty cycle optimised for wheel direction shown on drawing (but sensor will operate in both directions)

Cable and Connection Definition

- 26AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection

Red wire Green wire White wire	Pin A Pin B Pin C	Pin 1 Pin 2 Pin 3	Supply Ground Signal

Note: The sensor will have two additional 26AWG wires within the cable. These are for manufacturing use only and

should not be connected.

Mechanical

- Air gap 0.4mm ±0.05mm
- Body diameter 10mm minimum
- Weight less than 50g (including cable)
- Aluminium alloy body, hard anodised and dyed black
- Polyester cable boss for strain relief to the sensor body
- Trigger wheel geometry (wheel to be supplied by customer)

Pitch Tooth width Tooth depth	5mm ±0.05mm 3mm min 5mm (or 3mm if through slot)
Gaps to have parallel sides (not teeth)	

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 20 to 150°C
- Aluminium alloy body, hard anodised and dyed black
- Sensor will be calibrated and tested using MESL standard test wheel unless otherwise specified
- Viton jacketed cable

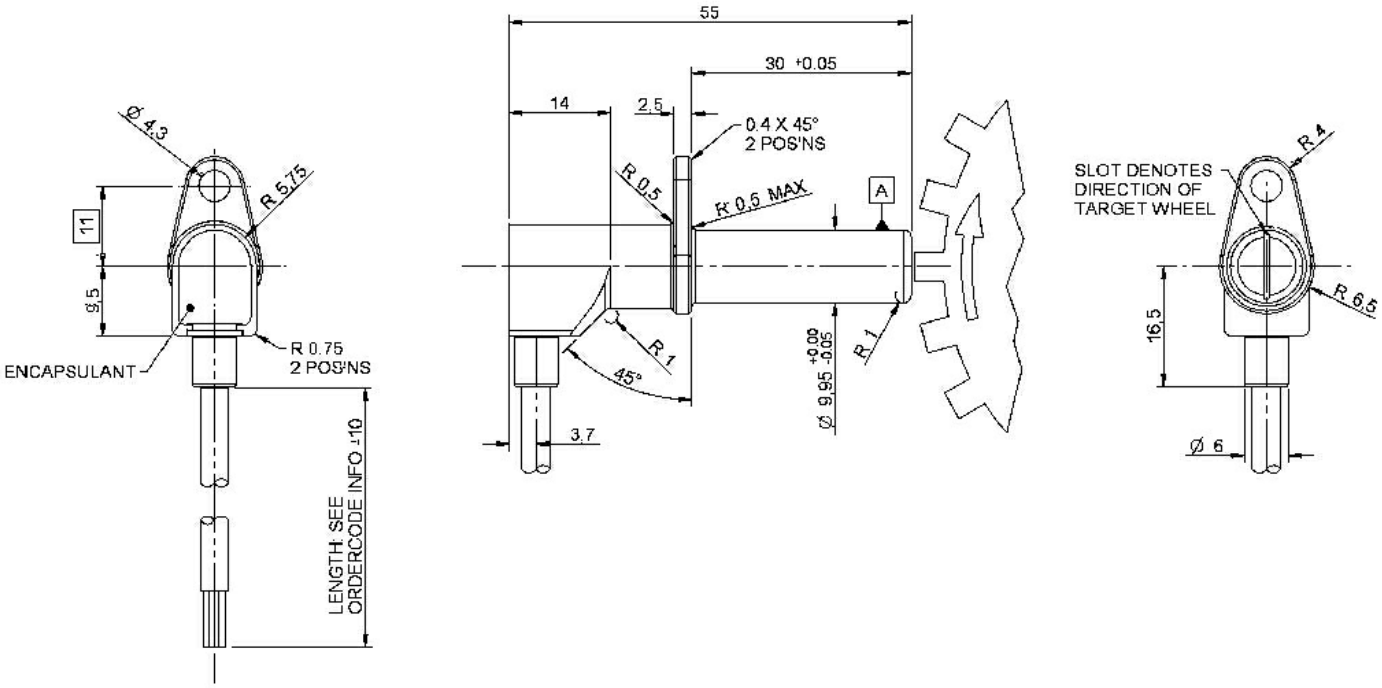
Application

- Dog position when car is stationary

Images/Diagrams

True Position Zero Speed

O 030 350 010 000


Ø 4.3
R 5.75
11
9.5
ENCAPSULANT
R 0.75
2 POS'NS
LENGTH: SEE
ORDERCODE INFO 110
55
30 +0.05
14
2.5
0.4 X 45°
2 POS'NS
R 0.5
R 0.5 MAX
A
R 1
45°
3.7
Ø 9.95 +0.00 -0.05
R 1
SLOT DENOTES
DIRECTION OF
TARGET WHEEL
R 4
R 6.5
16.5
Ø 6

Zero Speed Sensor Differential Hall Effect

Hall Effect sensors give an output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). This sensor has a single Hall Effect element and is therefore not orientation dependant. The sensor responds to changes in magnetic field strength by corresponding to tooth passing frequencies down to 0Hz. As each tooth passes the sensor, the digital state of the output changes.

Please request our installation datasheet for further details.

In Detail

Electrical

- Supply voltage 9V to 15V unregulated
- Supply current 1.5 to 6mA
- Open collector output
- Output current 25mA maximum
- Frequency response 0Hz to 15kHz
- Output polarity is low in the presence of a tooth

Cable and Connection Definition

- 22 AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection

Red wire Green wire White wire	Pin A Pin B Pin C	Pin 1 Pin 2 Pin 3	Supply Signal Ground

Mechanical

- Air gap 1.0mm maximum (0.8mm recommended)
- Body diameter 9mm
- Weight less than 50g (including cable)
- Polyester cable boss for strain relief to the sensor body

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -10 to +175°C
- Aluminium alloy body, hard anodised and dyed black

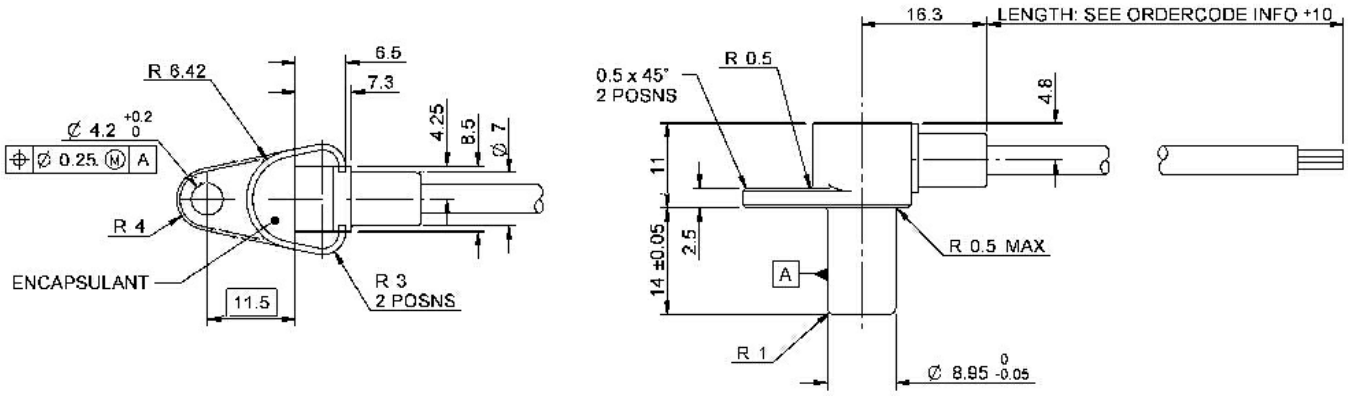
Application

- Wheel speed

Images/Diagrams

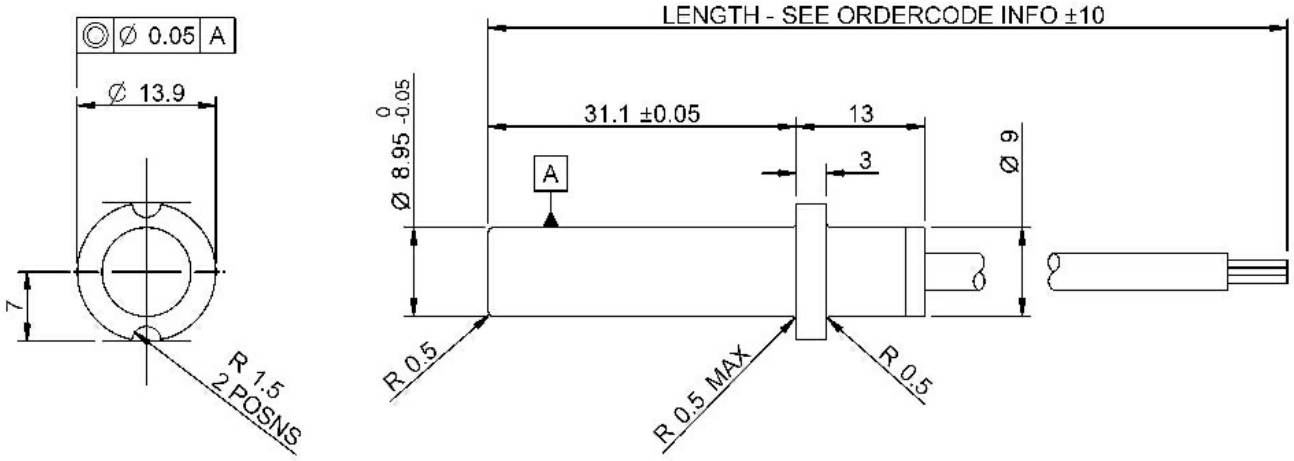
Zero Speed

O 030 350 008 003



Zero Speed

O 030 350 008 004


Ø 0.05 A
Ø 13.9
7
R 1.5
2 POSNS
LENGTH - SEE ORDERCODE INFO ±10
Ø 8.95 0 -0.05
31.1 ±0.05
13
3
A
Ø 9
R 0.5
R 0.5 MAX
R 0.5

Sport Sensor Range

Sport Sensor Range DHE Speed Sensor

DHE (Differential Hall Effect) sensors give an output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). To improve noise resistance, the sensor has two Hall effect elements and only responds to changes in magnetic field strength corresponding to tooth passing frequencies above 15Hz. As each tooth passes the sensor, the digital state of the output changes

In Detail

Electrical

- Supply voltage 9V to 15V unregulated
- Supply current 5 to 15mA
- Open collector output
- Output current 35mA maximum
- Frequency response 15Hz to 20kHz
- Output polarity depends on the rotational direction of the target wheel

Cable and Connection Definition

- 55 Spec 22 AWG un-screened cable
- Cable length 1000mm
- Connection

Red wire Green wire White wire	Supply Signal Ground		

Mechanical

- Air gap 1.5mm maximum
- Body diameter 12mm
- Weight less than 30g (including cable)
- Aluminium alloy body, anodised and dyed blue
- Polyester cable boss for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- RW200 jacketed cable
- Operating temperature -10 to +150°C
    - Vibration 50 to 2500Hz @ 40g 8hrs per axis
    - Shock 50g ½ sine 11ms 10 times per axis

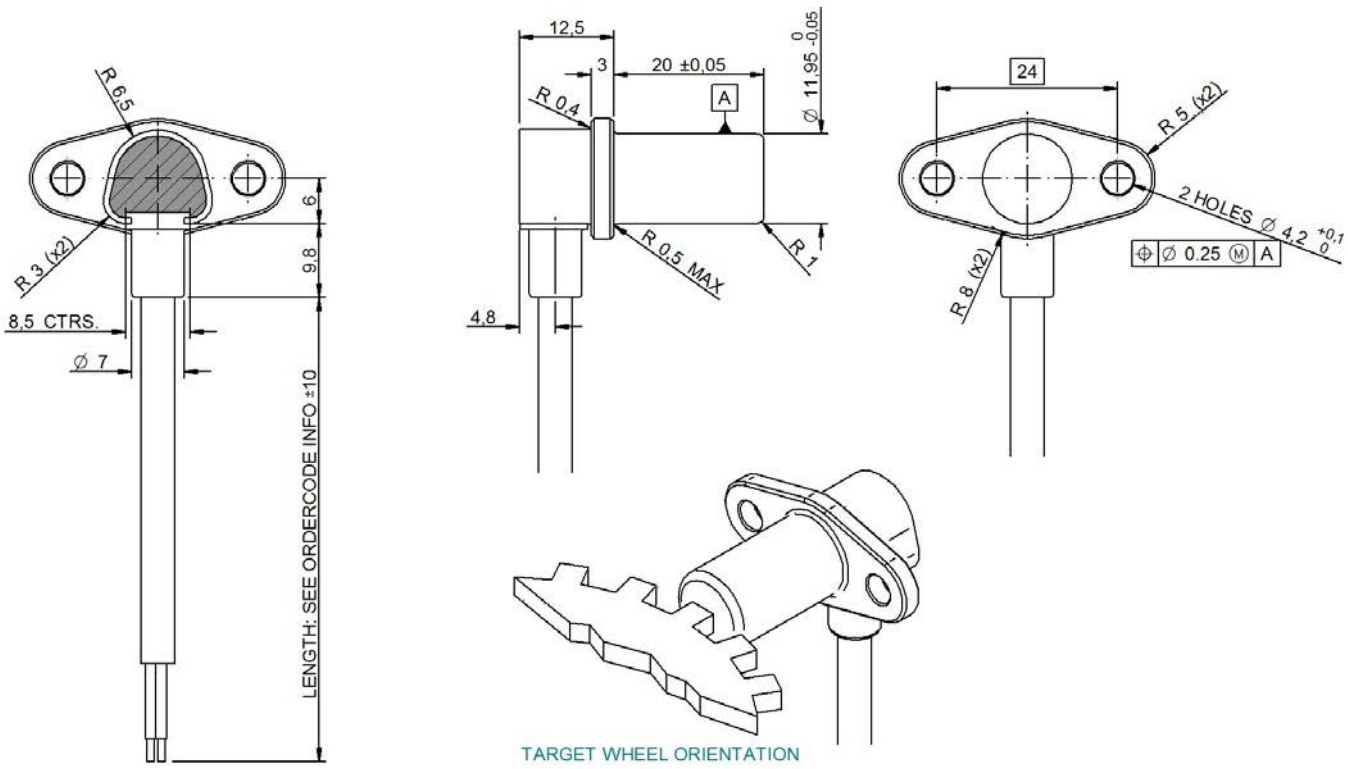
Application

- Wheel speed
- Gearbox input and output shafts

Images/Diagrams

W 030 350 000 342

Sport Sensor Range DHE Speed Sensor



Ordercodes

Description	Ordercode
Sport Sensor Range DHE Speed Sensor	W 030 350 000 342

Sport Sensor Range Fluid Temperature

Temperature sensors have a well-defined relationship between electrical resistance and temperature, allowing them to measure temperature precisely. The high resistance of the Pt1000 element makes it less sensitive to the resistance of harness wires and connector contacts. The sensor body is made of a thermally conductive material and is as small as possible to produce a rugged device which gives an accurate measurement of temperature with a fast response.

In Detail

Electrical

- Nominal resistance Pt1000 = 1000 ohm @0°C
- Accuracy:

  ±0.4K typ, ±1.0K max (-10 to +100°C)

  ±1.0K typ, ±1.5K max (+100 to +150°C)
- Response time 4sec typ, 10sec max in still air

Cable and Connection Definition

- 55 spec 22AWG un-screened cable
- Cable length 1000mm
- Connection

White wire Black wire	Signal + Signal -

Mechanical

- Weight less than 30g (including cable)
- 17/4PH Steel body
- Polyester cable boss for strain relief to the sensor body
- Sensor is supplied with bonded seal

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- RW200 jacketed cable

- Operating temperature range -25°C to +150°C (sensor characterised to 150°C)
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

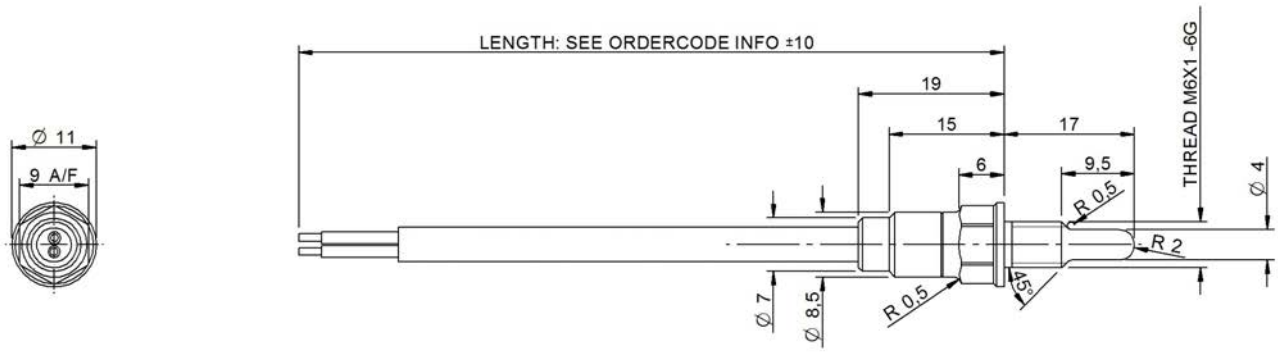
Application

Oil, water, fuel temperature measurement

Images/Diagrams

W 030 300 010 113

Sport Sensor Range Fluid Temperature Sensor



Ordercodes

Description	Ordercode
PT1000 Sensor	W 030 300 990 113
Spare Sealing Washer	O 030 300 990 011

Sport Sensor Range Inductive Speed

Inductive sensors give a voltage output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). The voltage increases with increasing speed and with a reduction of the gap between the sensor and the target. The sensors are suitable for use with interfaces that trigger on threshold or zero crossing. The body has an exposed core for increased sensitivity.

In Detail

Electrical

- Resistance 450 to 600 ohm
- Cut-in speed 66rpm (3k load) 50rpm (no load)
- Cut-in speed is defined as the speed to achieve 400mV pk-pk @ 0.8mm air gap, with a 120mm diameter target wheel (3kohm load and no load values are given)
- Output polarity follows tooth form, that is a rising metal edge on the wheel generates a rising voltage output from the sensor

Cable and Connection Definition

- 55 Spec 22 AWG un-screened cable
- Cable length 1000mm
- Connection

White wire	Signal +
Black wire	Signal -

Mechanical

- Air gap 1.0mm (max), 0.8mm (nominal)
- Body diameter 12mm
- Weight less than 30g (including cable)
- Aluminium alloy body, anodised and dyed blue
- Polyester cable boss for strain relief to the sensor body
- Sensor is axi-symmetric, special orientation is not required

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- RW200 jacketed cable
- Operating temperature -10°C to + 150°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Shock 50g ½ sine 11ms 10 times per axis

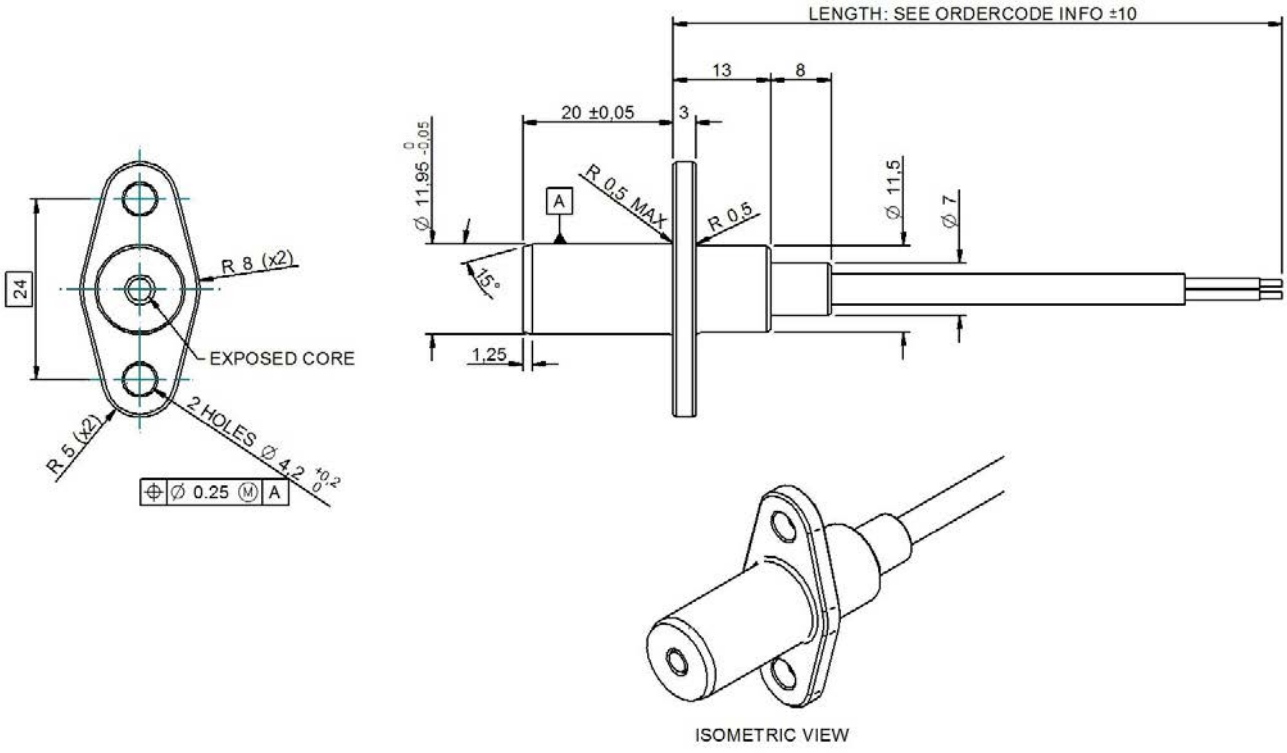
Application

- Cam shaft Speed
- Crank shaft Speed

Images/Diagrams

W 030 350 001 304

Sports Sensor Range Inductive Speed Sensor



Ordercodes

Description	Ordercode
Sport Sensor Range Inductive Speed Sensor	W 030 350 001 304

Sport Sensor Range Barometric Sensor

The gain, offset and thermal drift of the pressure sensor is digitally compensated to minimise errors and to create a single-ended, amplified output in the 0.5 to 4.5 Volt range. The output voltage changes with the absolute pressure applied to the pressure port

In Detail

Electrical

- Compensated pressure range 400 to 1150mbar
- Supply voltage 8 to 16V unregulated
- Supply current 14mA max
- Output voltage @ 400mbar = 0.5V ±80mV over compensated temperature range
- Output voltage @ 1150mbar = 4.5V ±80mV over compensated temperature range
- Maximum output voltage 4.85V
- Overall accuracy ±15mbar over compensated temperature range
- Electrical output impedance 100 ohms
- Frequency response 70Hz

Cable and Connection Definition

- 55 spec 24 AWG un-screened cable
- Cable length 1000mm
- Connection

  Red Supply

  Green Ground

  White Barometric Signal

Mechanical

- Weight less than 30g (including cable)
- Aluminium alloy body, anodised and dyed blue
- Polyester cable boss for strain relief to sensor body

Environmental

- Minimum pressure 400 mbar

- Maximum pressure 1150 mbar
- Pressure overload 3.6 bar for 300s
- Pressure media must be a non-corrosive gas
- Sensor body resistant to standard motorsport fluids
- Maximum humidity 100% but water should not be allowed to condense inside the unit
- RW200 jacketed cable
- Operating temperature -40 to +125°C
- Compensated temperature range 0 to 85°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

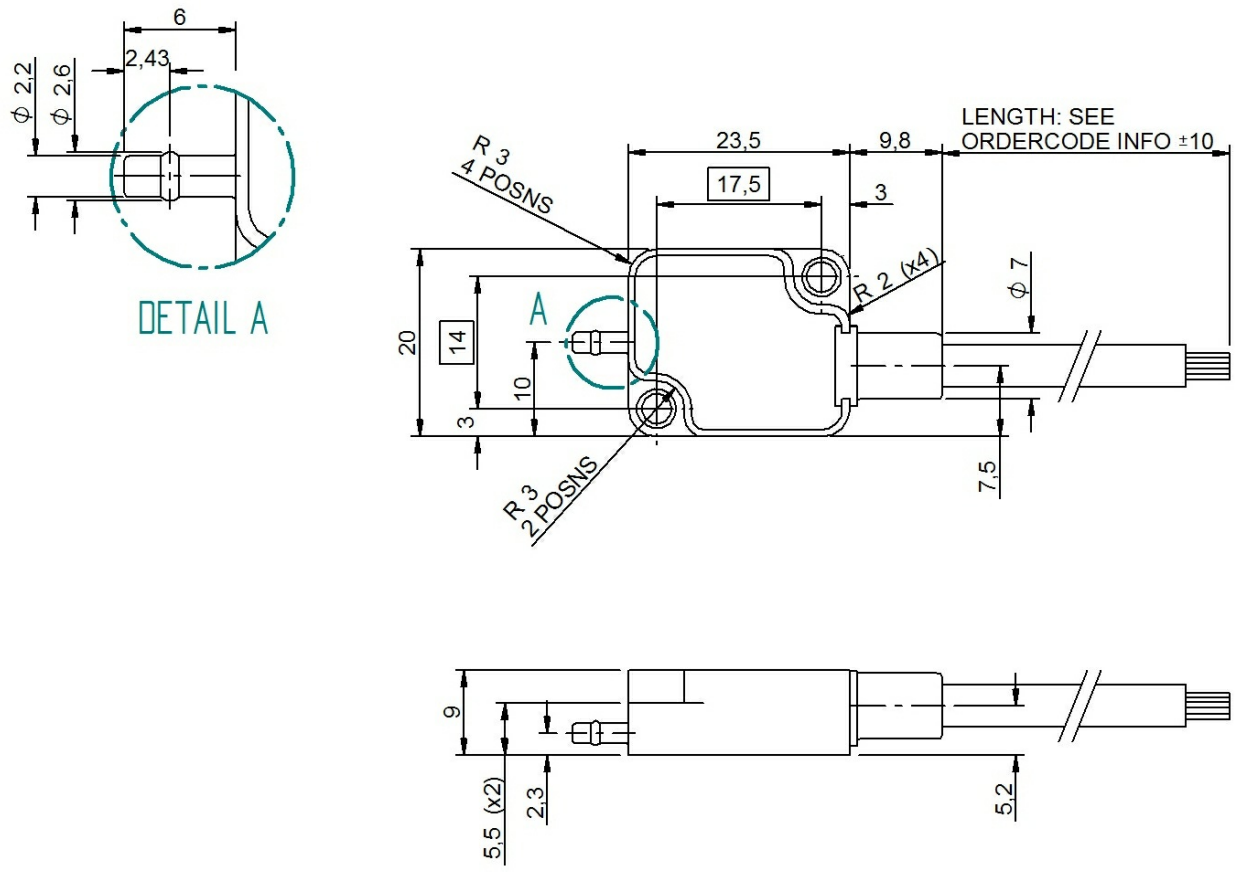
Application

- Manifold pressure

Images/Diagrams

Sport Sensor Range Barometric Sensor

W 030 330 043 071



Ordercodes

Description	Ordercode
Sport Sensor Range Barometric Sensor	W 030 330 043 071

Sport Sensor Range Rotary Hall Effect

The output of the Rotary Hall-effect sensor is a voltage which changes in direct proportion to the shaft angle. The sensor is non-contact, using Hall elements to determine the angle of a magnet. An integral shield is incorporated to reduce interference from nearby ferrous objects and stray magnet fields. A supply voltage of 5.00V ratiometric provides an output range between 0.2 and 4.8V.

In Detail

Electrical

- Supply Voltage 5.00±0.5V d.c. ratiometric
- Overvoltage protection 20V
- Reverse polarity protection -10V
- Supply current 16mA max
- Output current 8mA max
- Output load >10kOhm recommended
- Start up cycle 15ms
- Angular range (see order code list)
- Output voltage 0.2 to 4.8V
- Independent non-linearity 1.5% FSO max
- Thermal drift □0.3%FSO max (20..125°C)
- Half-voltage position tolerance ±2° max
- Sampling rate 200µs (5kHz)
- Resolution <0.1°
- Shaft rotation direction for a rising or falling output is shown on drawing
- Shaft orientation for half-voltage position is shown on drawing

Cable and Connection Definition

- 55 spec 24AWG un-screened cable
- Cable length 1000mm
- Connection

  Red wire Supply

  White wire Signal

Green wire	Ground

Mechanical

- Weight less than 35g (including cable)
- Aluminium alloy body, anodised and dyed blue
- Stainless steel shaft
- Internal shield to prevent interference from stray magnetic fields or nearby ferrous objects
- Polyester cable boss for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- RW200 jacketed cable
- Operating temperature -40 to +125°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Shock 50g ½ sine 11ms 10 times per axis

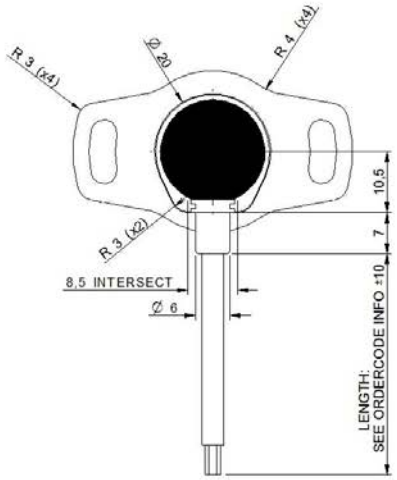
Application

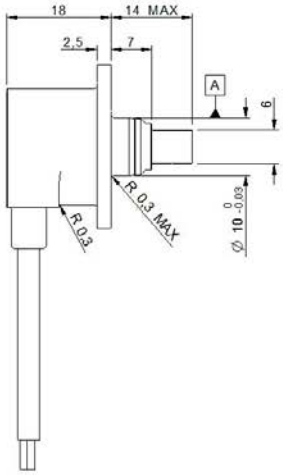
- Gearbox barrel
- Steering angle
- Throttle actuator

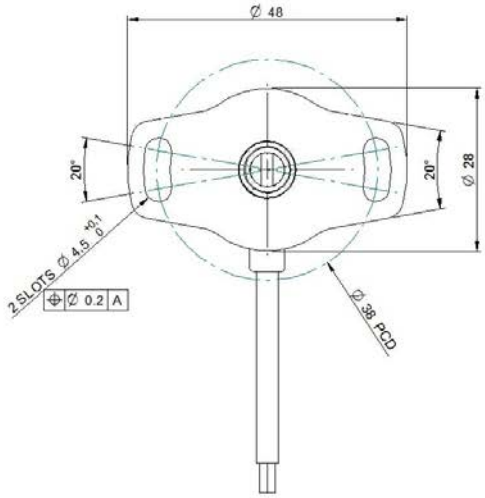
Images/Diagrams

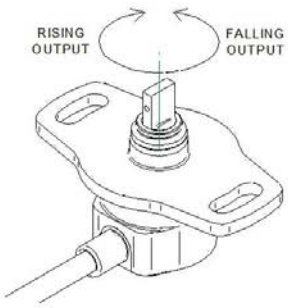
Sport Sensor Range - RHE

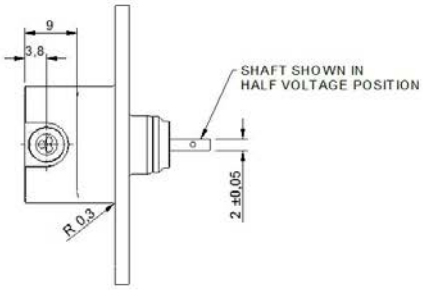
W 030 370 021 XXX











Ordercodes

Description	Ordercode
50 degree	W 030 370 021 092
130 degree	W 030 370 021 091
360 degree	W 030 370 021 088

Sport Sensor Range Zero Speed

Hall Effect sensors give an output when subjected to a changing magnetic field. The field is set up by a magnet inside the sensor body and changes when ferromagnetic teeth are passed beneath the sensor (no magnets are required in the target). This sensor has a single Hall Effect element and is therefore not orientation dependant. The sensor responds to changes in magnetic field strength by corresponding to tooth passing frequencies down to 0Hz. As each tooth passes the sensor, the digital state of the output changes.

In Detail

Electrical

- Supply voltage 9V to 15V unregulated
- Supply current 1.5 to 6mA
- Open collector output
- Output current 25mA maximum
- Frequency response 0Hz to 15kHz
- Output polarity is low in the presence of a tooth

Cable and Connection Definition

- 55 Spec 22 AWG un-screened cable
- Cable length 1000mm
- Connection

Red wire	Supply
Green wire	Signal
White wire	Ground

Mechanical

- Air gap 1.0mm maximum (0.8mm recommended)
- Body diameter 12mm
- Weight less than 30g (including cable)
- Aluminium alloy body, anodised and dyed blue
- Polyester cable boss for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- RW200 jacketed cable
- Operating temperature -10 to +150°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Shock 50g ½ sine 11ms 10 times per axis

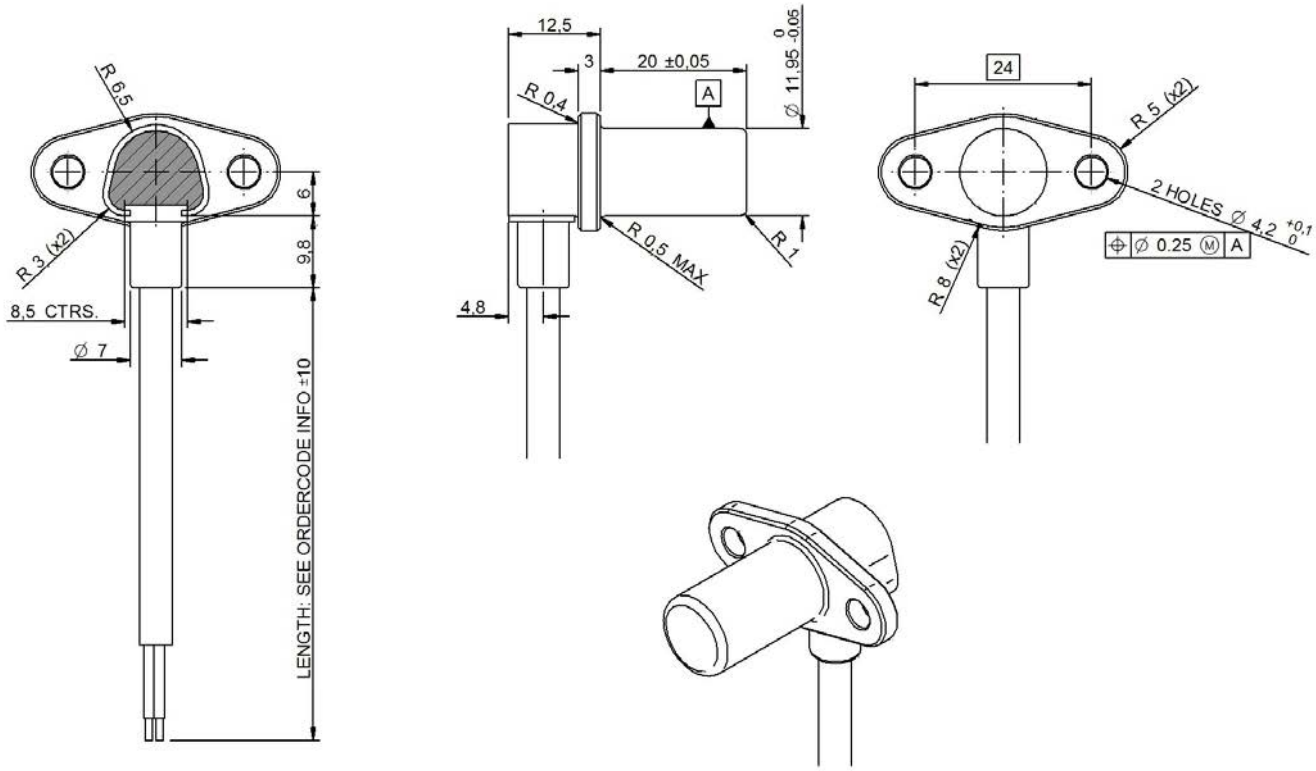
Application

- Wheel speed
- Cam speed

Images/Diagrams

W 030 350 008 066

Sport Sensor Range - Zero Speed Sensor



Ordercodes

Description	Ordercode
Sport Sensor Range Zero Speed Sensor	W 030 350 008 066

Sport Sensor Range Air Temperature

Temperature sensors have a well-defined relationship between electrical resistance and temperature, allowing them to measure temperature precisely. The high resistance of the Pt1000 element makes it less sensitive to the resistance of harness wires and connector contacts. The sensor element is exposed to the airflow to give the fastest possible response to changes in temperature.

In Detail

Electrical

- Nominal resistance Pt1000 = 1000 ohm @0°C
- Accuracy ±0.4K typ, ±1.0K max (0 to +70°C)
- Response time 4sec typ, 10sec max in still air

Cable and Connection Definition

- 55 spec 22AWG un-screened cable
- Cable length 1000mm
- Connection

White wire	Signal +
Black wire	Signal -

Mechanical

- Weight less than 30g (including cable)
- 17/4PH Steel body
- Polyester cable boss for strain relief to the sensor body
- Sensor is supplied with bonded seal

Environmental

- Resistant to standard motorsport fluids
- PT1000 elements unaffected by humidity
- RW200 jacketed cable
- Operating temperature range -25°C to +150°C (sensor characterised to 70°C)
    - Vibration 50 to 2500Hz @ 40g 8hrs per axis

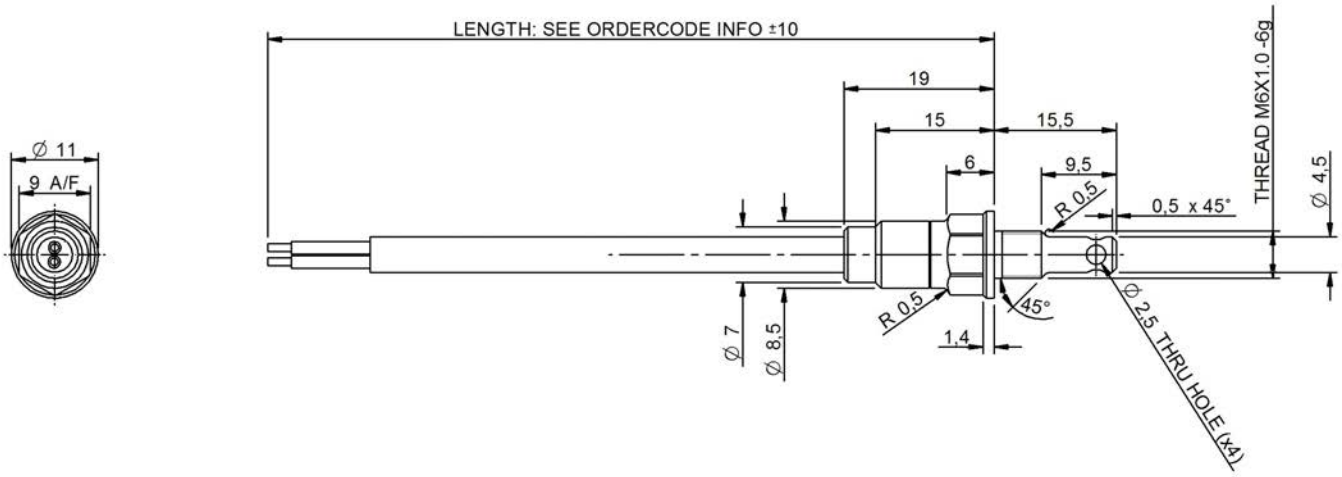
Application

- Inlet air manifold temperature measurement

Images/Diagrams

W 030 300 021 098

Sport Sensor Range - Air Temperature



Ordercodes

Description	Ordercode
PT1000 Sensor	W 030 300 021 098
Spare Sealing Washer	O 030 300 990 011

Temperature

Air Box Fire Detector Air box

The air box fire detector uses an optical sensor for the detection of fire in the air box. The sensor output toggles between two states – LOW and HIGH. When the light intensity is above the threshold level the output goes HIGH.

In Detail

Application

- Fire detection in the air box.

Electrical

- Supply voltage 8 to 16V unregulated
- Supply current < 20mA
- Reverse polarity protection
- Output voltage HIGH=4.0±0.1V, LOW=1.0±0.1V
- Optimum detection angle = 6°
- Turn-on threshold at 25°C = 0.25mW/cm2
- Peak Response = 880nm

Cable and Connection Definition

- 26AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection:
-

Red wire	Supply
White wire	Signal
Blue wire	Ground

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Integral cable boss
- Weight less than 30g (including cable)

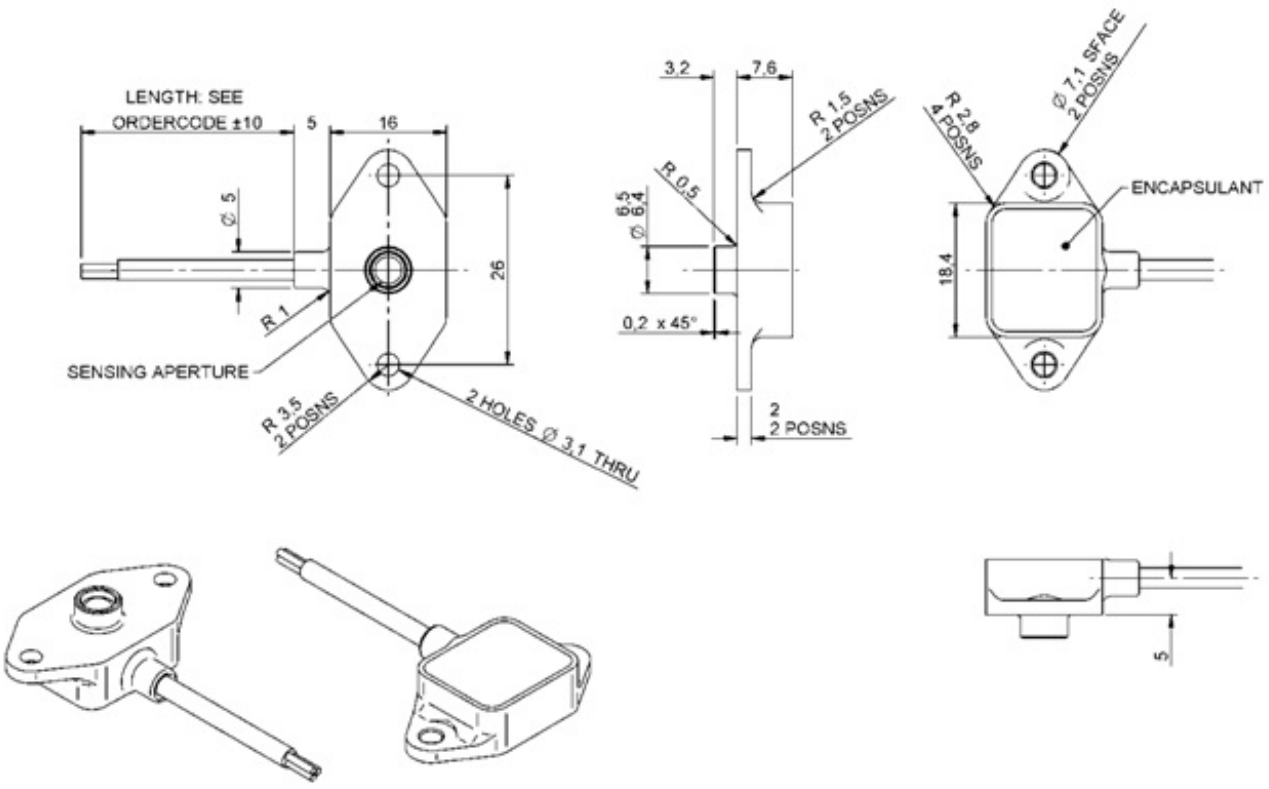
Design and manufacture is in-house, so if our existing designs do not suit your application we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths.

Please contact our technical consultancy service who will be pleased to help.

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature 0 to +100°C
- Vibration 100 to 1000Hz, 24hrs per axis
- DR25 jacketed cable

Images/Diagrams



Ordercodes

Description	Ordercode
1000mm	O 030 300 034 000

Temperature Sensor Air (Extra Small)

Temperature sensors have a well-defined relationship between electrical resistance and temperature, allowing them to measure temperature precisely. The sensor body is made of a thermally conductive material and is as small as possible to produce a rugged device which gives an accurate measurement of temperature with a fast response.

This sensor is small enough to install in traditional thermocouple locations, but has the advantage of straightforward Pt1000 interfacing.

In Detail

Application

Temperature measurement.

Electrical

- Sensing element Pt1000
- Nominal resistance 1000ohm @ 0°C
- Accuracy:
- ±0.4K typ, ±1.0K max (0 to +100°C)
- ±1.0K typ, ±1.5K max (+100 to +150°C)
- Response time 4sec typ, 10sec max in still air

Cable and Connection Definition

- 26AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection both wires (Signal + and Signal -) are white

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Weight less than 45g (including cable)
- Internal joints made with high melting point solder

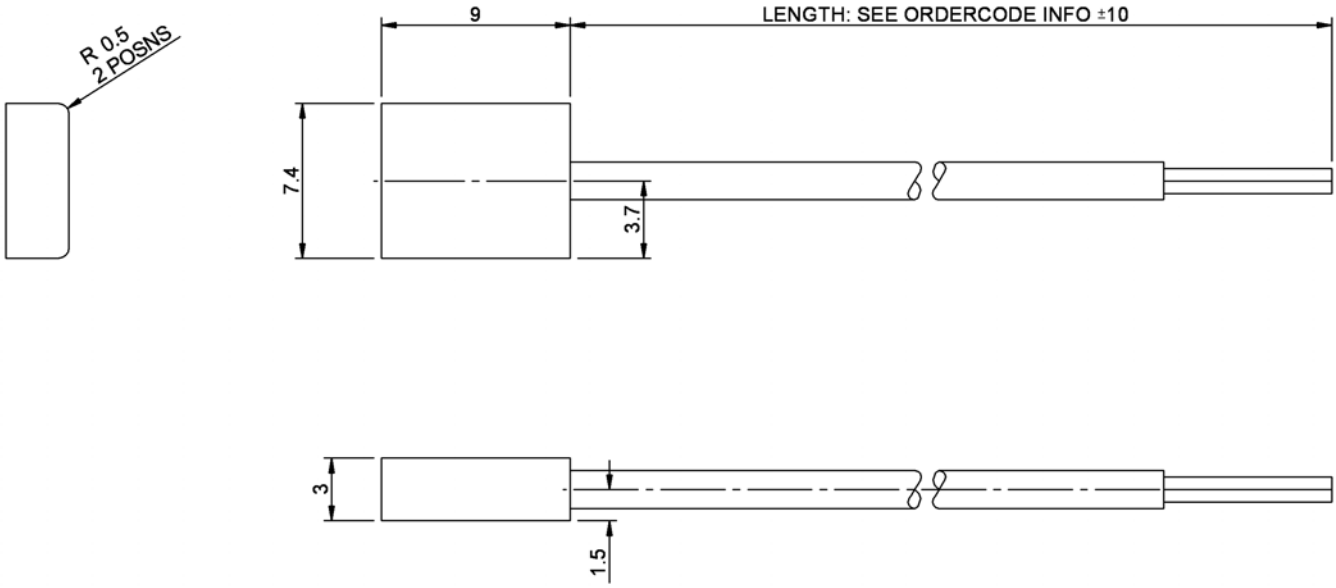
Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple

modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Operating temperature -25 to +150°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- DR25 jacketed cable

Images/Diagrams



Ordercodes

Description	Ordercode
1000mm	O 030 300 021 084

Temperature Sensor Surface

Temperature sensors have a well-defined relationship between electrical resistance and temperature, allowing them to measure temperature precisely. The sensor body is made of a thermally conductive material and is as small as possible to produce a rugged device which gives an accurate measurement of temperature with a fast response.

This sensor is small enough to install in traditional thermocouple locations, but has the advantage of straightforward Pt1000 interfacing.

In Detail

Application

Temperature measurement.

Electrical

False

Cable and Connection Definition

- 28AWG un-screened cable
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection:
-

White wire	Signal +
Black wire	Signal -

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Weight less than 15g (including cable)
- Internal joints made with high melting-point solder

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical

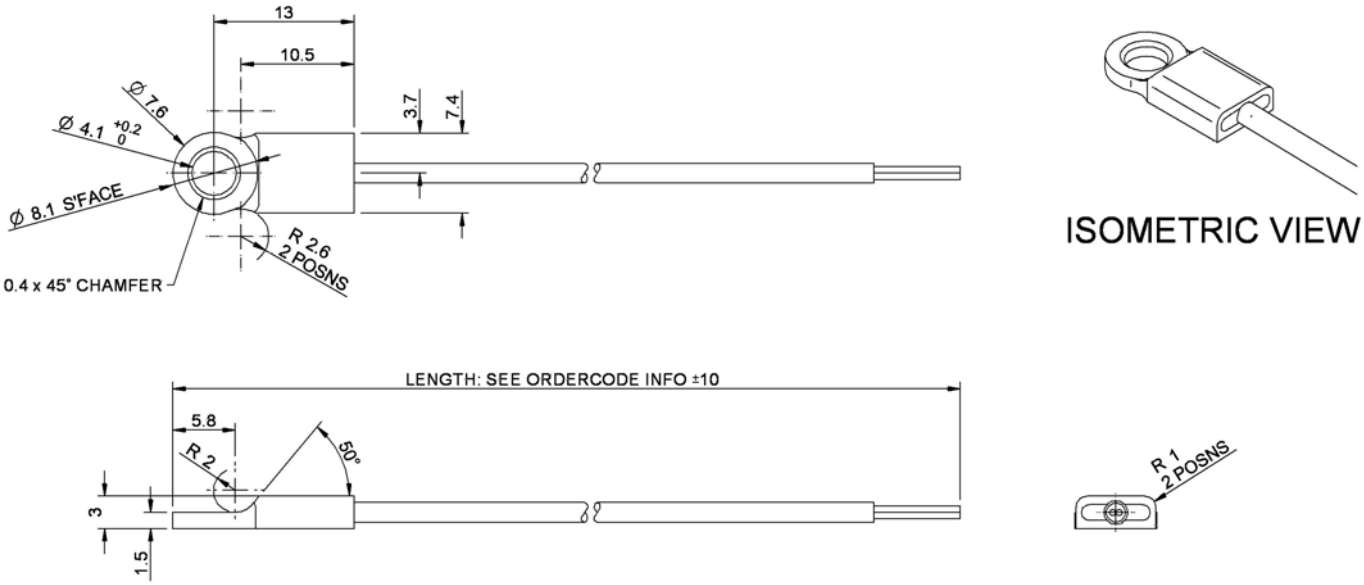
consultancy service who will be pleased to help.

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Vibration 50 to 2500Hz @ 40g 8hrs per axis
- Operating temperature -25 to +200°C
- DR25 jacketed cable (150°C)

Images/Diagrams

O 030 300 021 081



Ordercodes

Description	Ordercode
	O 030 300 021 081

Temperature Sensor Air

Temperature sensors have a well-defined relationship between electrical resistance and temperature, allowing them to measure temperature precisely. Pt100, Pt1000 or NTC elements are available. We recommend the Pt1000 element because its higher resistance makes it less sensitive to the resistance of harness wires and connector contacts. Our control units and data loggers support Pt1000 as standard, but can be modified to support Pt100 and NTC. The sensor element is exposed to the airflow to give the fastest possible response to changes in temperature.

The sensor is very compact and is available in various body types of which the M6 type is exceptionally small.

Please request our installation datasheet for further details.

In Detail

Application

Inlet air manifold temperature measurement.

Electrical

- Nominal resistance:
-

NTC	5000 ohm	@25°C
Pt100	100 ohm	@0°C
Pt1000	1000 ohm	@0°C

- Accuracy: ±0.4K typ, ±1.0K max (0 to +70°C)
- Response time 4sec typ, 10sec max in still air

Cable and Connection Definition

- Un-screened cable, gauge as specified in order details
- Cable length is shown on the order details but any length is available on request
- Various automotive and military standard connectors are available
- Connection:
-

White wire	Pin A	Pin 1	Signal+

Black wire	Pin B	Pin 2	Signal-

Mechanical

- Body types are aluminium alloy (hard anodised and dyed black), titanium or polyester (see order details)
- Weight (including cable) is shown in the order details
- Polyester cable boss or Elastomer boot for strain relief to the sensor body

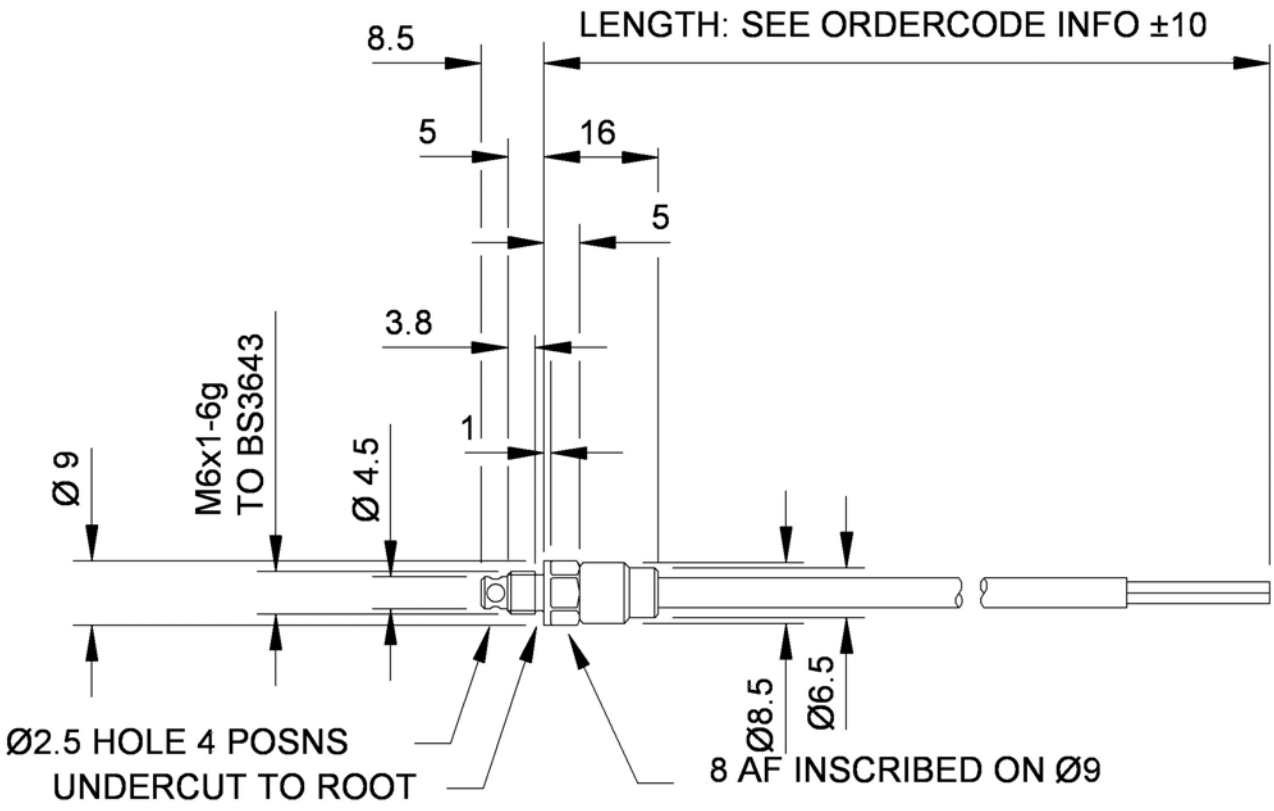
Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Environmental

- Resistant to standard motorsport fluids
    - Less than 75% average over one year
    - Less than 93% over 56 days in any one year
    - Pt1000/Pt100 elements unaffected by humidity
- Sensor housing and element operating temperature range -25°C to +200°C (sensor characterised to 70°C)
- Cable boss/shrink boot maximum operating temperature 150°C
- Viton jacketed cable maximum operating temperature 200°C
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Images/Diagrams

O 030 300 021 033



Ordercodes

Description	Ordercode
Pt1000, Titanium, 1000mm, 24AWG, 40g	O 030 300 021 033
Pt1000, 14mm, Titanium, 1000mm, 22AWG, 40g	O 030 300 021 031
O-ring Accessory	O 030 300 990 000
NTC 15.75mm Titanium 1000mm 22AWG 40g	O 030 300 021 028
O-ring Accessory	O 030 300 990 000
Pt1000 Titanium 1000mm 22AWG 40g	O 030 300 021 067

Thermal Camera

Thermal Camera Thermal Camera

The thermal camera allows real-time thermography with 100Hz frame rate via USB 2.0 interface. The camera is lightweight, compact and rugged (IP65). Measurement ranges of -20°C to 100°C, 0°C to 250°C, or 150°C to 900°C are selectable in software. Interchangeable lenses are available with 6°x5°, 23°x17°, 48°x31° and 72°x52° field of view.

We recommend the EPL-310 as a data logging unit for use with the Thermal Camera.

In Detail

Electrical

- Supply and operation via USB 2.0 interface (supply 4.75V to 5.25V)
- Supply current 500mA max
    - -20°C to 100°C
    - 0°C to 250°C
    - 150°C to 900°C
    - 6°x5° f=35.5mm, 500mm min distance
    - 23°x17° f=10mm, 200mm min distance
    - 48°x31° f=5.7mm, 200mm min distance
    - 72°x52° f=3.3mm, 200mm min distance
- Spectral range 7.5µm to 13µm
- Frame rate 120Hz
- Optical resolution 160x120 pixels
- System accuracy (at 23°C) ±2% or ±2°C, whichever is greater
- Display resolution 0.1°C
- Measurement resolution 0.08°C with 23°x17° lens, 0.1°C with 48°x31° or 72°x52° lens and 0.3°C with 6°x5° lens
- Emissivity 0.1 to 1.0 adjustable in software
- Warm up time 10 minutes

Software

- Software interface shown below:

Connection Definition

Deutsch ASU0-03-05PN

- Connections:

Pin 1	Supply
Pin 2	Ground
Pin 3	Data +
Pin 4	Data –
Pin 5	Not connected
Connector body	Screen

Mechanical

- Aluminium alloy body, hard anodised and dyed black
- Weight approx. 140g
- 70 shore Viton AV mounts

Environmental

- Resistant to standard motorsport fluids
- Operating temperature 0 to 50°C [2]
- Storage temperature -20 to 70°C
- Relative humidity 20 to 80% non-condensing
- Vibration 100-1000Hz random 9.1G_{rms}
- Shock 25G, ½ sine, 11ms

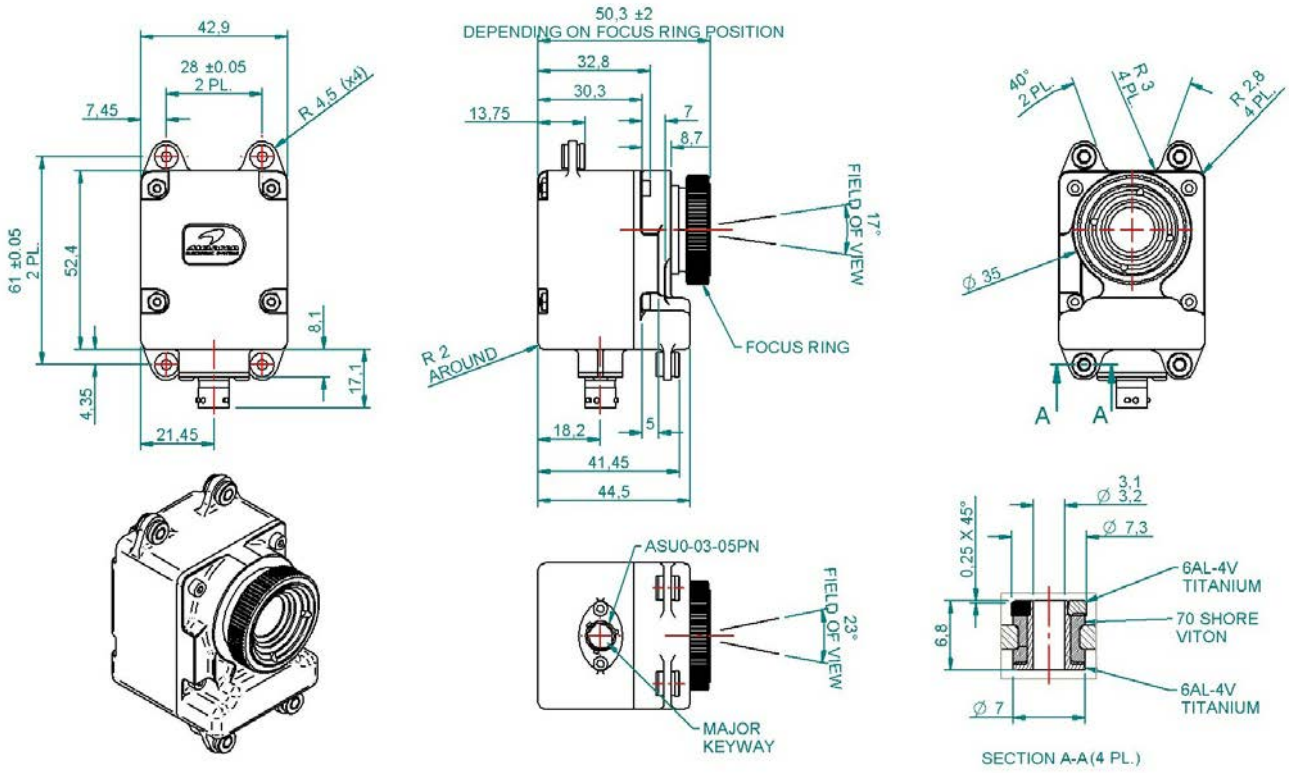
[2] Running outside the operating temperature range will significantly reduce the life of the camera.

Note

You will require an Export Licence to use the Thermal Camera outside of Europe/USA

Images/Diagrams

O 030 300 033 XXX



Ordercodes

Description	Ordercode
Lens - 23° x 17°	O 030 300 033 003
6° x 5° lens	O 030 300 990 018
23° x 17° lens	O 030 300 990 019
48° x 31° lens	O 030 300 990 020
72° x 52° lens	O 030 300 990 021
Lens cover for 23° x 17° optic	O 030 300 990 025
PC USB 2.0 test lead 1m length	O 030 300 990 016

Thermocouple

Thermocouple Exhaust Gas

This sensor uses a K-type Chromel/Alumel thermocouple and is intended for use in high-temperature, high-vibration environments. Control units and data loggers support K-type thermocouples. The sensor is short and compact to minimise its susceptibility to vibration.

Please request our installation datasheet for further details.

In Detail

Application

- Exhaust gas temperature measurement.

Electrical

- K-type DIN 43710
- Measurement range 0 to 1200°C

Cable and Connection Definition

- 24AWG un-screened cable using K-type materials
- Cable length is shown on the order details
- Various automotive and military standard connectors are available
- Connection:
-

Green wire	Pin A	Pin 1	Signal+
White wire	Pin B	Pin 2	Signal-

Design and manufacture is in-house, so if our existing designs do not suit your application, we can provide cost effective customised parts to suit even the most demanding application. No engineering charges are made for simple modifications such as customer specific connectors, cable protection and cable lengths. Please contact our technical consultancy service who will be pleased to help.

Mechanical

- Stainless steel body
- Measurement point 1.5mm from tip of probe
- Weight specified in ordercode details

- Viton boot for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Continuous operating temperature:
-

Probe	0 to 1200°C
Cable	-10 to +200°C

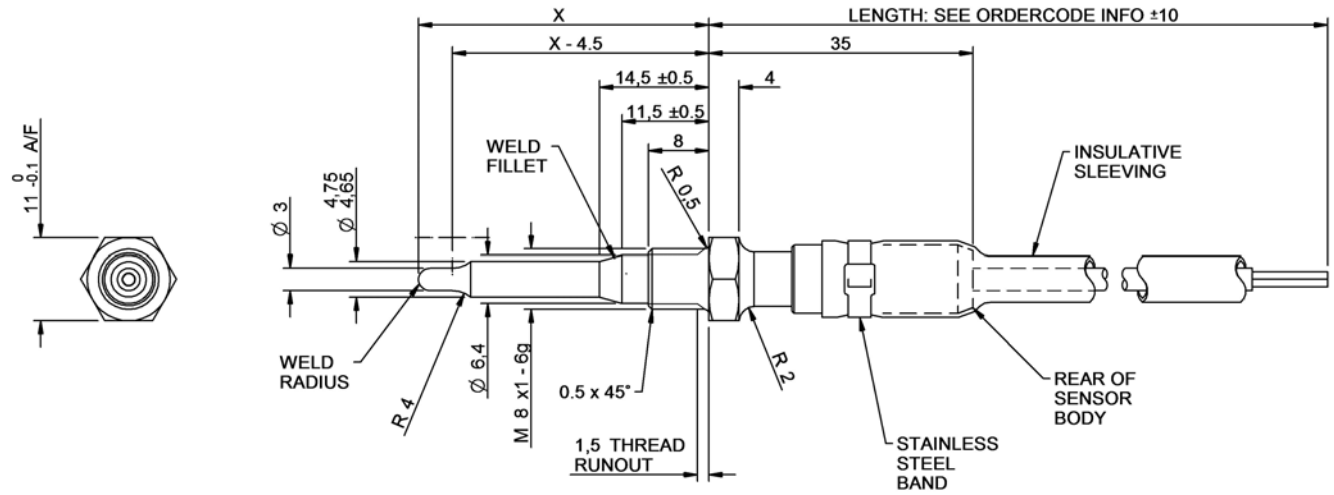
- Maximum short-term operating temperature:
-

Probe	+1300°C
Cable	+250°C

- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Images/Diagrams

O 030 300 002 XXX



Ordercodes

Description	Ordercode
1000mm, Textalu 1202 sleeving, 50g weight, 63mm dimX	O 030 300 002 006
1000mm, Textalu 1202 sleeving, 50g weight, 38.5mm dimX	O 030 300 002 011

Thermocouple Air Temperature

This sensor uses a J-type Iron/Constantan thermocouple and is intended for use where a fast response time is required

In Detail

Electrical

- J-type to BS/EN 60584.1
- Measurement range 20 to 500°C

Cable and Connection Definition

- 24AWG un-screened cable using J type materials
- Cable length is shown on the order details but any length is available upon request
- Connection:

Black wire	Signal+
White wire	Signal-

Mechanical

- Weight less than 50g (including cable)
- Stainless steel body
- Measurement point 1.5mm from tip of probe
- PEEK boss for strain relief to the sensor body

Environmental

- Resistant to standard motorsport fluids
- Maximum humidity 100%
- Continuous operating temperature:

Probe	0 to +500°C
Cable	-10 to +150°C
Cable boss	0 to 230°C

- Maximum short term operating temperature:

Probe	+500°C
Cable	+200°C
Cable boss	+260°C

- DR25 thin wall sleeving
- Vibration 50 to 2500Hz @ 40g 8hrs per axis

Ordercodes

Description	Ordercode
1000mm	O 030 300 032 000

Torque

Drive Plate Torque System NASCAR

The Drive Plate Torque System uses a low power radio link to transfer digitised strain measurements from a rotating wheel hub to a stationary antenna mounted nearby. The signals are passed to a receiver where they are decoded and output as CAN bus messages and analogue outputs.

The system is intended to be installed on a single vehicle. The system works with a hub transmitter on each drive wheel.

The hub transmitter can be fitted for testing and removed for race trim. When fitted back onto the same hub for further testing no additional calibration is required. A cover is provided to protect the contacts when in race trim.

In Detail

System Configuration

The full system consists of the following components:

- Two strain gauge receivers
- Two receiver antennas
- Two wheel hubs fitted with strain gauges,LH & RH
- Two hub transmitters

The following customer provided equipment is required to configure the system:

- CAN Bus Protocol Analyser (capable of sending user defined messages)
- PC with RS232 interface and terminal emulator software

Electrical

- CAN interface
- Analogue output
- Antenna supplied
- Supply +8 to +16 VDC
- Max positive torque 4.75±0.15V (clips at 4.9V)
- Zero torque 2.5±0.15V
- Max negative torque 0.25±0.15V (clips at 0.1v)
    - Standard system = ±7% of full scale

    - Thermally compensated system = ±3.5% of full scale
- Internal ½ AA Sulfuryl Chloride battery, can be renewed by user with no need to return to MES
- Battery life 24 hours (typ) of continuous transmission
- RS232 interface for calibration
- Internal antenna
- Sampling rate 100Hz

Wheel can be fitted and removed with transmitter in place. A cover is supplied for the gauge contacts when the transmitter is not in place.

Each hub transmitter has a unique encrypted serial number. The system can be supplied with calibration data already programmed into the transmitter.

Application

- Measurement of strain on drive plate

Mechanical

- Black anodised aluminium case
- Black polyester body
- Operating temperature +10°C to 125°C
- Customer to supply drive plates to MES
- Wheel hubs to be individually numbered
- Service covers allows drive shaft to be serviced while the plate remains on the car
- MES can provide a balanced and thermally compensated full bridge gauge circuit on the hub

Connection

- AS2-10-35PN Connector
-

Pin 1	Supply +ve
Pin 2	RS232 In
Pin 3	Screen
Pin 4	CAN+
Pin 5	CAN-
Pin 6	NC
Pin 7	NC
Pin 8	Signal Ground
Pin 9	Analogue Signal
Pin 10	Power Ground

Pin 11	RS232 Out
Pin 12	NC
Pin 13	RS232 Ground

Ordercodes

Description	Ordercode
Drive plate receiver	O 030 205 005 000
Receiver ANA/CAN/PWR connection cable	O 030 205 990 000
1.5m antenna extension cable	O 030 205 990 004
NASCAR Wheel Hub transmitter	O 030 205 006 000
RS232 programming cable	O 030 205 990 001
Spare battery	O 030 205 990 002

Wireless Strain Gauge System AC Coupled

The AC coupled wireless strain gauge system uses a low-power radio link to transfer up to two digitised strain measurements to a stationary antenna mounted nearby. Signals from the antenna are passed to a receiver where they are decoded and output as CAN bus messages.

The strain measurements are also available in analogue output form.

The system consists of a strain gauge transmitter and external battery unit, a receive antenna and a tyre strain receiver. The strain gauge elements are provided by the customer and are not deliverables.

In Detail

Application

- Measurement of strain gauge on the car, e.g. tyre strain gauge.

Electrical

- 10-bit resolution
- Accuracy ±1% RO
- Non-linearity ±1% RO
- Hysteresis ±1% RO
- Repeatability ±1% RO
- Nominal resistance 120ohm ±2%
- Temperature effect on zero balance ±0.3% RO/°C
- Temperature effect on zero output ±0.2% RO/°C
- Sample rate 5000 samples/s on each channel
- Bandwidth 0.1Hz – 2.5kHz
    - Nominal centre frequency 433.92MHz
    - Transmission bandwidth 2MHz

The transmitter has three operating modes: sleep, standby and full rate

Each transmitter will be factory configured with a ‘corner ID’ corresponding to the location where it will be fitted.

- Supply voltage 8 to 16Vdc (unit is protected against reverse polarity and transients)
- Supply current 105mA typical @ 12V
- RF input 50ohm

- CAN bus 2.0B active, 1Mbps
- RS232 57.6kbps for configuration
- Three diagnostic LEDs on case: processor status, CAN Busy and RF channel
- Configurable parameters: corner ID, receiver attenuation setting and CAN base ID

- CR2 battery
- 3.0V nominal voltage

Connection

- Strain gauge connector ECN FF 304 XLM
- Antenna connector via case-mounted bulkhead SMC socket
- Battery connector FGN FF 304 YLC

- FGN FF 304 XLM

- Main unit connector AS2-10-35PN
- Antenna connector 25SMA-50-2-6/111 NE

For pin-out details, please contact MESL.

Mechanical

- Black anodised aluminium case
- Weight 33g including flying lead
- Resistant to standard Motorsport fluids

- Black anodised aluminium case
- Weight 35g including battery
- Resistant to standard Motorsport fluids

- Black anodised aluminium case
- Weight 115g
- Resistant to standard Motorsport fluids
- 434 MHz helical antenna, approx 79mm long x 15mm diameter, with SMA female connector

Environmental

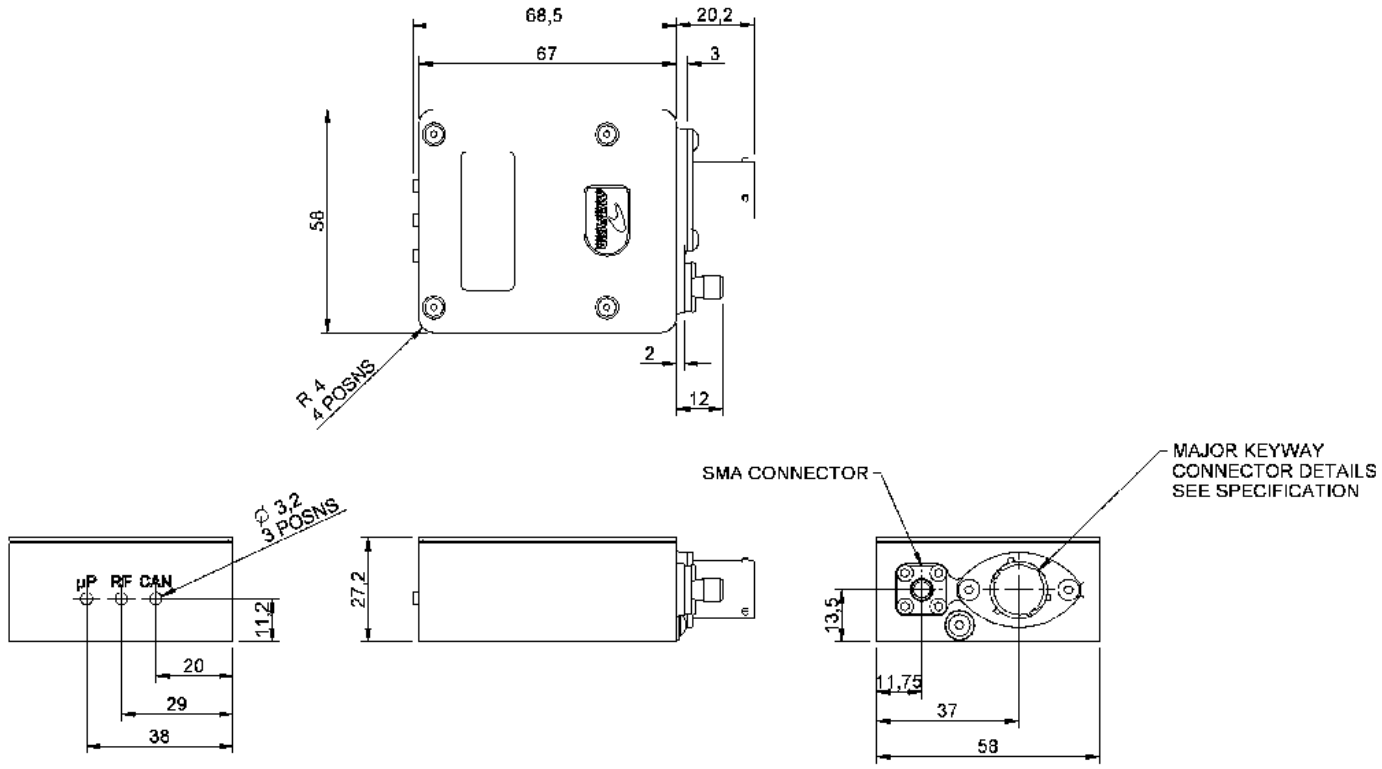
- Resistant to standard Motorsport fluids
- Operating temperature 0 to + 85°C
- Storage temperature 0 to + 85°C
- Vibration 40 to 2500Hz @ 40g 8hrs per axis
- Shock 50g(max), 1/2sine for 11ms, five times per axis

- Operating temperature 0 to + 85°C (battery life may be reduced by up to 20% at low temperatures)
- Storage temperature 0 to + 85°C
- Vibration 40 to 2500Hz @ 40g 8hrs per axis

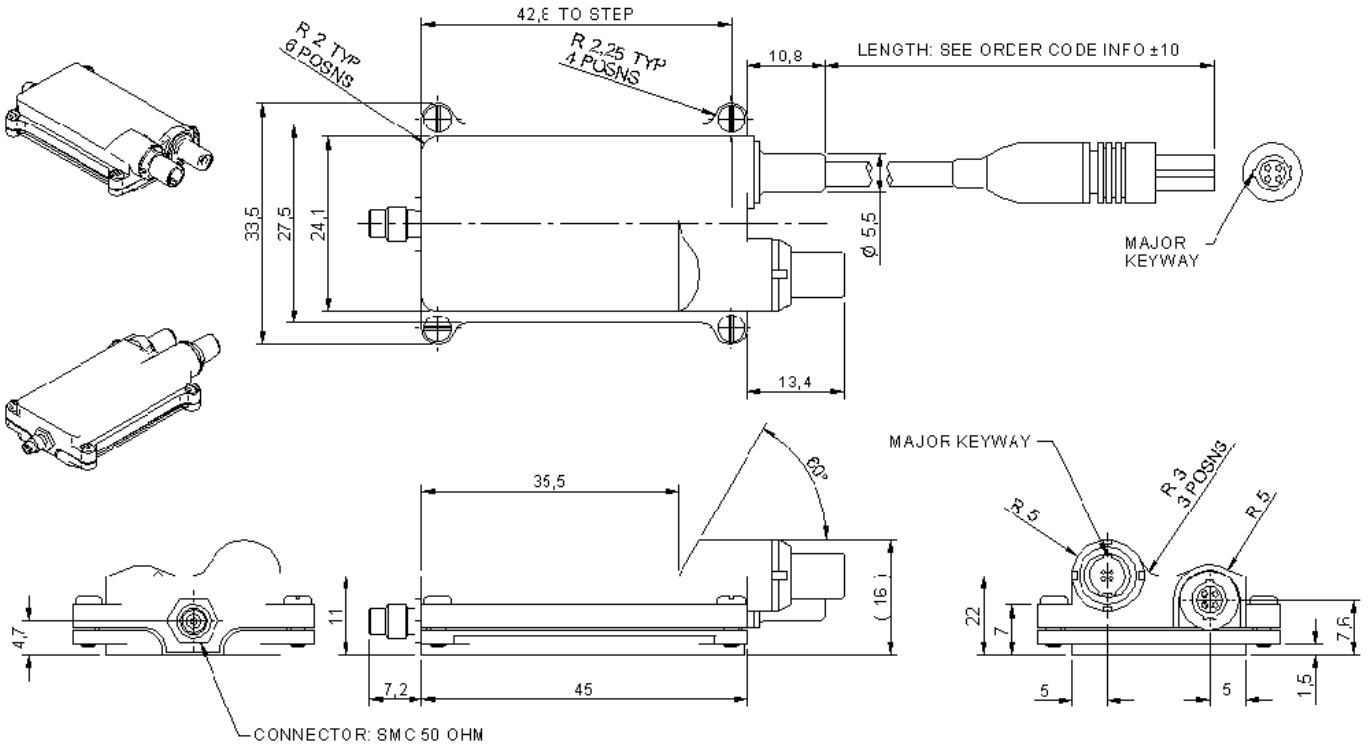
- Shock 50g(max), 1/2sine for 11ms, five times per axis
- Operating temperature 0 to + 85°C
- Storage temperature -20 to + 85°C
- Vibration random spectrum for two hours in one axis

Images/Diagrams

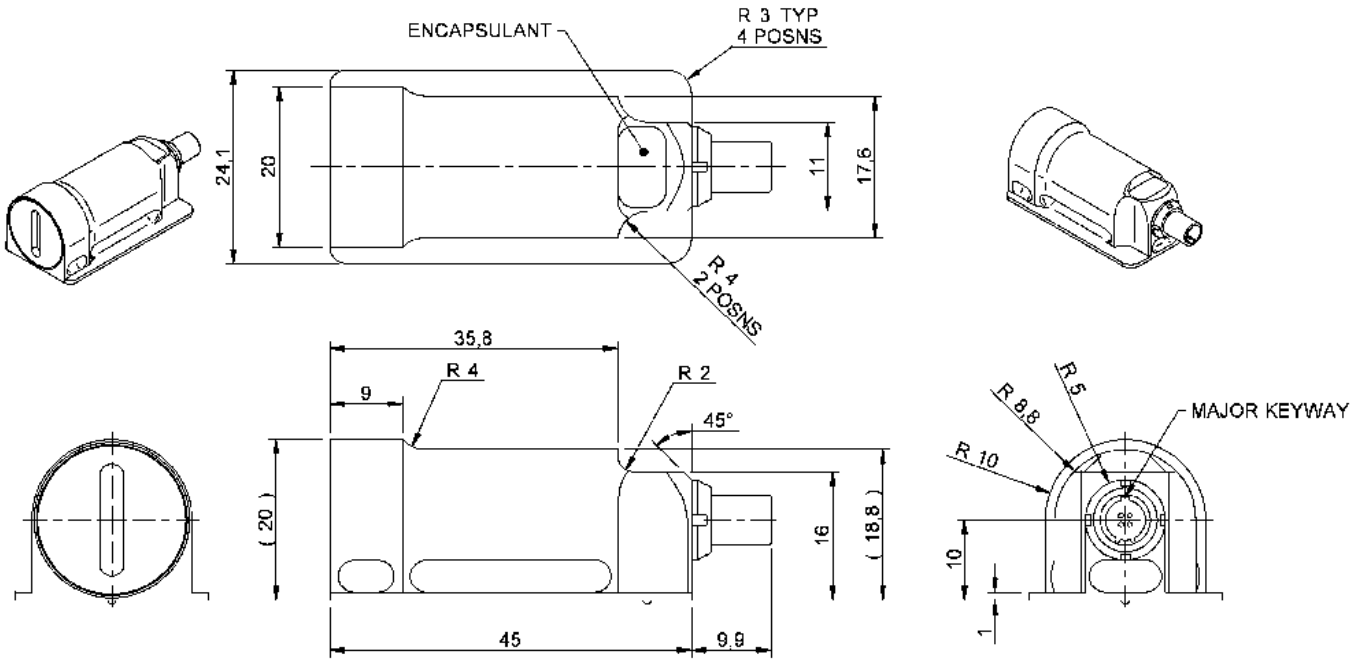
Receiver



Transmitter



Battery



Ordercodes

Description	Ordercode
SGR strain gauge receiver	O 030 205 007 000
Receiver ANA/CAN/PWR connection cable	O 030 205 990 000

Description	Ordercode
1.5m antenna extension cable	O 030 205 990 004
SGT strain gauge transmitter	O 030 205 008 000
Transmit antenna	O 030 205 990 003
SGT-B external battery pack	O 030 205 008 001
Spare battery	O 030 205 990 005

Software

Calibration

System Monitor Vehicle Tuning and Configuration Tool

System Monitor is a software package for configuring and tuning automotive control systems. It has built-in support for motor sport systems and can be tailored to support third party control units.

System Monitor not only allows you to tune data for your program versions, but also manages those versions on disk, allowing them to be located quickly for programming or modification

Familiar controls and extensive use of menus and accelerator keys make System Monitor easy to set up and to use, both at the track and at the test bed.

System Monitor supports configuration of logging for the ATLAS display and analysis software and both applications can run on the same PC.

In Detail

Programming/Tuning

- Programming of unit with program and data versions
- Tuning of unit by modification of editable parameters including 1 and 2D maps
- Live tuning with verification; integrity checks to ensure synchronisation between System Monitor and the unit
- On-track tuning when linked by a suitable RF data connection to the unit
- Display of measurement parameters for live feedback
- Data Wizard to compare and merge data versions
- Management of program and data versions stored on disk
- Can be used with PUMA for automated tuning

Diagnostics

- Monitoring of unit errors and events
- Virtual parameters derived from measurements by user defined mathematical functions
- User definable alarms triggered by measurement conditions
- Configuration and uploading of engine and chassis history reports
- Enter a message and send it directly to the unit
- Read and display an area of memory on the unit

Configuration

- Configuration of parameter data to be logged in memory on the unit

- Configuration of parameter data to be transmitted over telemetry
- Programming of sensor and actuator calibration data
- Configuration of CAN transmit and receive messages
- Configuration of analogue and digital signals from MESL units.

Extendibility

- ActiveX interface provides functions for communication with unit, allowing creation of both custom measurement displays and unit commands
- Extensive on-line help with context sensitive links to the application

Scalability

- Supports multiple application programs on the same control unit
- Supports multiple control units

What you need

- An ASAP2 file for each application program which will run on the unit. This describes the editable (configurable) and measurement parameters
- A hex file for each application, containing the program code and base data
- A link between the PC and the control unit. This can be either Ethernet, HDLC or CAN

Getting started

- Create a program version and data version for each application; these are more compact and faster to open and compare than the ASAP2 and hex files
- Create a project, linking together a program and data version for each application plus the screen layouts and other configurations you will make
- In the Parameter Explorer, find the editable and measurement parameters for all applications

Monitoring

- Program the unit with each of the program and data versions you have created
- Create windows displaying measurement parameters
- Create custom displays with the grid window, showing measurement values or freeform text in any cell
- Display bar and dial graphs for visual feedback.
- Show changes over time with the oscilloscope window
- System Monitor requests and receives on-line data from the unit, allowing you to observe the behaviour of each application as it runs
- Create windows for diagnostics showing errors, events and areas of memory
- Show changes over time with the oscilloscope window

Tuning

- Create windows showing scalar, 1-axis map, 2-axis map, array and string parameters
- Change values by simply typing or by using the maths bar (eg +10%)
- 1 and 2 axis maps can be viewed as Graphs. Change values by dragging points on the graph.

- Send changes to the unit as they are made or download all changes later
- Make adjustments easily using the rotary controls on the VE-81 Adjustment board, connected via the serial port
- System Monitor detects when the contents of its edit buffer differ from the contents of the live tune RAM on the unit

Version Management

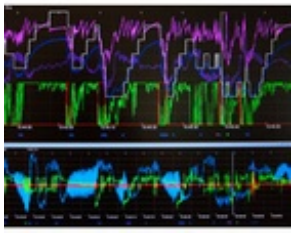
- Save your tuned data versions to directories reserved for each application
- Compare your tuned data with the base version or with tuned data from earlier program versions
- Select and merge parameters from earlier data versions
- Print reports for easy reference

Custom Commands

- Write your own commands and interfaces to help in your development process

Data Analysis

ATLAS Advanced Telemetry Linked Acquistion System



ATLAS is a software package which is used to obtain, display and analyse data from control systems such as those used within motorsport and automotive applications.

Familiar controls and extensive use of the mouse, menus and accelerator keys make it easy to set up and to use

ATLAS is used by the professional data analyst working with data acquired by telemetry or uploaded from a data logger. ATLAS is appropriate for an individual data analyst or for many engineers all monitoring telemetry together.

ATLAS is equally suitable for analysis of either lap or open road based data.

In Detail

Features

- Highly customizable, Workbook containing Pages and Displays
- Graphical Timeline for easy navigation through data
- View, analyse and compare live telemetry data with uploaded logged data
- Checks for automated monitoring of engine and chassis
- Fast data handling to deal in real-time with the large quantities of data
- Highly customizable

Timeline

ATLAS has several features to help you navigate through your data. The

- Shows: Out lap, Timed laps and In lap
- The data currently on view is highlighted on the Timeline so you can easily see where you are
- Mouse operations allow quick and easy lap selection
- Linkable displays, enabling the same period of time to be shown, even when scrolling
- Distance and Time modes are supported

Displays

Several types of display are provided to give you different views of your data:

- On-screen controls for: parameter layout; lap offset adjustment; navigation and data selection
- Traces can be hidden or flashed

- Gradient and reference cursors
- Automatic and manual scrolling

Many displays can show data in real time as it is received by telemetry. Other displays can be updated automatically as each lap is completed.

You can Zoom in to magnify the view in the Waveform and Scatter displays

Other displays allow you to analyse your data:

Parameters

ATLAS handles each item of incoming data as a parameter. The value of the parameter is displayed and analysed by including it in a Display:

- Parameters are selected in a browser or dragged from another display.
- Parameter properties allow you to control how a parameter is displayed: they may be either local to a single display or global to the whole workbook.

Analysis

As well as the special analysis displays (Loadmap, Histogram, Summary and FFT), ATLAS offers the following analysis features:

Software Interfaces

ATLAS can be used to in conjunction with other Windows® applications:

- ATLAS is ActiveX compliant and most ATLAS commands are available to this interface
- The InPlace Display can be used to run other applications within ATLAS
- Session data can be Exported and Imported in various formats including MATLAB
- A third-party Session DLL allows you to write drivers to access other data formats
- Constants, used in functions, can be read from an external application such as a spreadsheet

Recording

ATLAS includes controls to record data from data loggers either directly (by wirelink) or in real time (by telemetry):

- ATLAS supports both narrow and wide band telemetry
- Wide band telemetry can be used in Burst mode (all the stored data is transmitted at one point on the circuit) or Retransmission mode (all the stored data is continually retransmitted and ATLAS uses later transmissions to fill-in drop outs and errors)
- ATLAS supports high speed wirelinks via 100Mbps Ethernet
- Ethernet telemetry allows you to view data at a test bed without any radio telemetry equipment
- Telemetry can be replayed
- The ATLAS package includes Data Servers. These run on a dedicated PC which accepts incoming data and broadcasts it on a network to the PCs running ATLAS
- A special Data Server is available to accept data from a Weather Station and to include it with session data

- Direct CAN logging.

Optional Product Extensions

Several optional ATLAS extensions are available:

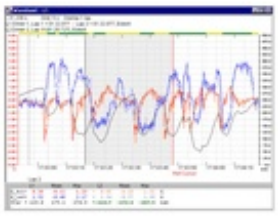
- Remote Data Server (RDS): Provides the ability to daisy chain two or more data servers remotely. For example, to transmit and transfer live telemetry data between track and factory locations.
- vTAG Server: This control sits within ATLAS and enables users to run MATLAB (Simulink) simulations against ATLAS data.

Licensing

ATLAS is licensed by a hardware device. This can take the following forms:

- USB dongle
- Site Licence by Ethernet

ATLASLite Advanced Telemetry Linked Acquistion System



ATLAS

In Detail

Workbook

- ATLAS

Graphical Timeline

- Shows: Out lap, Timed laps and In lap
- Highlights where data on view is in the session
- Mouse selectable lap or part of lap
- Time-linked displays
- Distance and Time modes

Displays

  - On-screen controls for: parameter layout; lap offset adjustment; navigation and data selection
  - Traces can be hidden or flashed
  - Gradient and reference cursors
  - Automatic and manual scrolling

You can Zoom in to magnify the view in the Waveform and Scatter displays.

Other displays allow you to analyse your data

- Histogram: shows the distribution of a parameter against time
- Summary: shows statistics on selected parameters for the whole session arranged by lap, section or segment
- FFT: performs frequency analyses on the data. The results can be shown as Fast Fourier transforms, Transfer functions or Correlations

Parameters

ATLAS

- Parameters are selected in a browser or can be dragged from another display
- Parameter properties allow you to control how a parameter is displayed: they may be either local to a single

display or global to the whole workbook

Recording

ATLAS

Analysis

ATLAS

Software Interfaces

ATLAS

Licensing

ATLAS

- Parallel port dongle
- USB dongle
- Ethernet card

Remote Data Server RDS

The Remote Data Server (RDS) enables live telemetry to be viewed simultaneously in different parts of the world. Several Remote Data Servers can be daisy chained together so that live telemetry data can be analysed at the track, factory and at the engine supplier

Often the available internet bandwidth available from a racetrack is limited, so it is not possible to get all the data back to the factory as quickly as might be desired. The RDS ensures that most recent data arrives first and then older data is backfilled when there is available bandwidth

In Detail

Main Features

The Remote Data Server provides the following features:

- Forward telemetry data as it is received from car
- Supports transfer of missing data offloads
- Manage usage of available bandwidth so that most recent data is sent first
- As bandwidth becomes available, RDS will backfill any earlier holes in the current run.
- Compression of data packets for more efficient use of internet link

Requirements

The Remote Data Server is part of ATLAS and requires that it is installed at both ends of the network.

Description

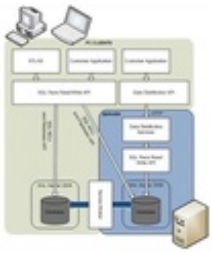
The Remote Data Server (RDS) is a feature of the ATLAS Data Server and allows one to connect to another over a local network or the internet. The Data Servers form a chain typically two or three links long, with the first Data Server reading data from the car via Ethernet or telemetry and subsequent Data Servers receiving data through the chain. Each Data Server can support two slave Data Servers for more complex configurations.

Each Data Server on the chain distributes data live to the local clients so that they behave as if they were all in the same garage, but not require a direct connection.

Security is provided by only allowing one of two IP addresses to connect to the master Data Server.

At the end of a run the session file will be closed so that it can be accessed immediately, if there are any holes in this file then they will be filled in a separate copy as soon as bandwidth is available.

SQL Race SQL Race



In professional motorsport, many megabytes of data are logged per lap and analysed in depth by different engineers and specialists at the track and at the factory. On-car data is further enriched by simulation data.

SQL Race is an API (Application Program Interface) for Microsoft SQL Server® 2008. It provides the building blocks to store and manage immense volumes of track, simulation and set-up data in its many different formats. It does this in a fast, efficient and user-friendly way while still allowing access through custom and standard methods.

In Detail

Main Features

SQL Race provides the following advantages:

- Storage of data received at rates of many Msamples/s can be achieved; thousands of times faster than writing directly to a database.
- Storing data received from data loggers, simulation tools or test rigs in real-time. Data may be real-time, out-of-sequence or post-event (offline).
- Retrieval of data as a set of converted samples ready for display or analysis in a fast and memory efficient manner.
- Seamless association and merging of data across runs.
- Automatic merging of samples across multi-frequency periodic and non-periodic data.
- Attachment of constants, maps, videos and documents to the run data.
- Efficient synchronisation of data between databases.
- User friendly access to data via SQL Server or C# API.

Fast Data Access

The essence of SQL Race is its ability to provide fast access to large quantities of time series data. Users may be viewing hundreds of parameters and hundreds of thousands of sample points and must be able to navigate quickly through the data with ease. SQL Race supports a rich set of data logging modes in real-time and offline. These include:

- Fixed frequency logging rates up to 1GHz
- Synchro logging, or near-regular rate logging. This can be used for logging at fixed points on an engine cycle or

the near regularity of a heart rate.

- Irregular logging, typically where many parameters are collected at a single time point.
- Scaled and unscaled data, in which each parameter has an associated conversion function that takes the raw logged value to an engineering value.
- Variable rate logging, where a parameter may be made up of several channels, each logged at a different frequency and under different conditions. SQL Race will intelligently merge all channels.
- Out-of-order data storage. Telemetry systems and disparate wireless data sources cannot guarantee continuous coverage, but a user's requirement is to always be able to see most recent data, so a backfill is necessary. Data is available for read as soon as it is received and any merging tables are updated automatically.

Run Associations

Often there are multiple sources of data either from multiple loggers on a car or because diagnostic data is collected from the environment or rigs. Each run has a GUID (Globally Unique Identifier) and these GUIDs or collections of GUIDs may be opened together to create a super run in which all the runs are presented as one.

Attachments such as constants, data maps, notes, and videos may be associated with the whole run, a set of laps or specific time e.g. a wing setting for the first stint of a race or the time at which a video was recorded

GUIDs may also be used to make associations between SQL Race runs and custom data that has its own schema, enabling tight coupling between all the electronically storable information about a run, whether it be the data from a probe, the vehicle/rig parts list, or other source.

Data Distribution

These databases may be managed by different organisations with their own IT policies. It is neither desirable nor practical to share a single database so the runs must be copied to each database. Furthermore there maybe confidential items in the data that are private to the engine or chassis side of the team. The API addresses these problems by:

- Synchronising on named columns
- Using signatures to compare datasets which provides a quick check that the data is the same with out the need to send a copy.
- Handle synchronisation across databases with different schemas.
- Restricting access "Allowed" parameter groups.

SQL Race Queries

Although logged data samples are highly compressed, row-set providers facilitate querying the data through SQL queries, thus allowing Excel and other reporting tools to access the data without going through the API

Viewing SQL Race Data with ATLAS

ATLAS is a separate product to SQL Race but integrates loggers, telemetry systems and simulation tools as data sources. The primary task of ATLAS is data viewing and comparing data from one or more runs both real-time and historic data

SQL Race enables ATLAS to analyse greater sets of runs and to search for trends and patterns in collections of runs

vTAG-RT VTAG-RT

vTAG-RT is a computational framework that runs on a standard PC and uses a real-time operating system to run a hardware-in-the-loop (HIL) system.

vTAG-RT's origins are the Electronic Control Units (ECU) of professional motor–sport where building highly configurable model based applications is key. vTAG-RT enables the tools used to develop ECU control models to also be used to monitor, tune and develop the plant model inside the HIL system.

vTAG-RT runs on RTOS-32 allowing the Mathwork's xPC block sets to be used to manage all I/O within the Simulink models.

The Graphical Development Environment (GDE) provides the automated build environment and a block library to allow the configuration of scalars and maps, the logging of signals, error and events plus some signal conditioning blocks.

In Detail

Features

- Real-Time HIL environment
- 1, 2, 5, 10, 50, 100ms, engine synchronous and background tasks
- Simulink code generation
- GDE block set
- Supports nine Applications and BIOS
- Tune editing via System Monitor
- Powerful data logger
- Data visualization through ATLAS

Programming

vTAG-RT is programmed with System Monitor. Each application may be programmed separately or from a single System Monitor project. System Monitor allows any of the tuneable parameters to be edited either on-line or offline.

Once programmed, vTAG-RT will autoboot from cold to its previously programmed state within a few seconds.

Logging

The logger inside the vTAG-RT BIOS is optimised to collect large amounts of data with the minimum use of memory and communications bandwidth. The logger includes:

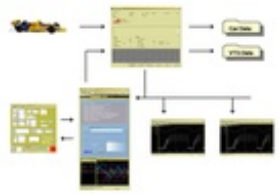
- 1Hz to 1kHz fixed frequency logging rates
- Engine synchronous logging and optional periodic log of everything.
- Trigger channels with pre and post triggers to enable data to be logged at different frequencies under different conditions
- Data packing, so that floating point engineering values maybe packed into smaller data types to save space.
- Data compression to pack constant or near constant data. This is particularly useful where switch positions need to be logged at a very high frequency, but where their values seldom change.

Logged data is sent live to ATLAS for analysis.

Extendibility

vTAG-RT is highly extendable as it makes no specific requirements of bus or system architecture. Mathwork's xPC provides a wide range of blocks for PC I/O cards. Custom blocks can also be written for new cards.

vTAGserver vTAG Server



vTAGserver is a computational framework that runs on a standard PC that allows fast analysis with complex models using either telemetry or recorded data from ATLAS .

vTAGserver sits as an in-place control inside an ATLAS installation and is fed live telemetry data. This data is fed into the models and processed information is sent back to the ATLAS Data Server to be broadcast to all connected users.

In this way, simulations are simultaneously available to all users who are connected. The models are normally created using Embedded Matlab, Simulink or Dymola, although C-coded functions are also supported.

vTAGserver is part of the vTAG suite of products that also includes: vTAG-RT, a real-time version with a hard real-time operating system, suitable for HIL systems and driver-in-the-loop simulations, and vTAG-310, a software emulator allowing simulation of several McLaren Electronics' electronic control units including the TAG-310B, as used in Formula One.

In Detail

Features

- Simulink code generation
- Dymola (modelica)
- GDE block set
- Supports nine Applications and BIOS
- Tunable parameter editing via System Monitor
- Data visualisation through ATLAS

Example applications

vTAGserver may be used to simulate a car or powertrain in order to supplement measured parameters from sensors with virtual sensor readings. It may also be used to derive performance and condition indices from complex data sets.

By broadcasting the outputs from vTAGserver to all ATLAS clients who are attached to a garage or factory network, users are able to access real and derived data seamlessly and in real-time, where telemetry is available.

Programming

vTAGserver is programmed with System Monitor. Each application may be programmed separately or from a single System Monitor project. System Monitor allows any of the tuneable parameters to be edited either on-line or offline.

Once programmed, vTAGserver will autoboot from cold to its previously programmed.

Real-time processing

vTAGserver is designed to operate in real-time when high rate telemetry is available. The system may also be used to process historical data, for example, straight after a cable upload. Once a (telemetry) data stream has stopped, and any missing data is retrieved in an upload, vTAGserver can re-run processing on all received data to fill any gaps.

In order full utilisation of multiple processor cores on the host PC, vTAGserver allows each application to run concurrently in a separate execution thread.

Modelling

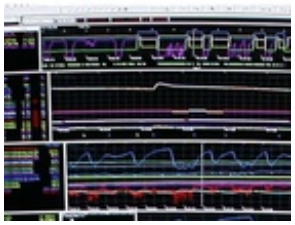
vTAGserver differs from the maths channels found in ATLAS and other standard data viewers in its ability to deal efficiently with complex systems with multiple inputs and outputs.

vTAGserver applications are normally built using Simulink and Embedded Matlab in conjunction with GDE 8.2 and the vTAG Platform Support Package which provides building blocks within Simulink to enable interaction with ATLAS parameter data.

When custom vTAG applications are built in Embedded Matlab and Simulink, a new Program Version (.pgv) file is produced which contains a compiled .dll with the code necessary to process and calculate results from incoming data.

Development Tools

Graphical Development Environment GDE v8.2



The GDE forms part of the integrated data analysis systems provided by McLaren Electronics.

The GDE facilitates model based embedded code generation. The entire system application code can be auto-generated from models developed with tools from The MathWorks.

The Graphical Development Environment (GDE) provides the automated build environment to generate code tailored to MES' ECUs, and block libraries which allow the configuration of parameters, the logging of signals, generation of errors and events plus other MES ECU specific control.

The GDE uses Matlab, Simulink, Real-Time Workshop and Embedded Coder Version (R2008a and later).

In Detail

Features

- Simulation and code generation environment
- System Monitor supported file generation
- Generation (via System Monitor) of downloadable files
- Different MES system targets are supported through Platform Support Packages

Optional Features

- XML driven automatic assembly of application models from component models. An XML driven Data Dictionary for configurable data may be used
- Automatic generation of HTML/XML documentation containing models browsable using Microsoft Internet Explorer.

Supported Targets

GDE v8.2 Platform Support Packages are currently available for the following targets:

- TAG-310 (FIA Formula One Standard ECU)
- TAG-320 (Engine control unit - check availability)
- TAG-400 (Engine control unit)
- HSL-300 (High speed logger)
- HSL-500 (High speed logger)
- CIU-100 (Control interface unit - check availability)
- vTAGserver

- vTAG-RT

Support for other MES systems can be implemented as required

Code Overview

Each supported MES system provides the ability to run one or more customer applications, on top of a MES provided BIOS. The BIOS, provided by MES, provides I/O, logging and task scheduling support for the application code.

The GDE provides the ability to generate an entire application from a single Simulink model.

The application supports multitasking at the rates supported by the target (typically, but not limited to 1ms, 2ms, 5ms, 10ms, 50ms, 100ms background and initialisation). Additionally, where supported by a target, an engine synchronous task rate is provided.

Where a target provides the ability for the application to run across multiple ECUs and processors, the GDE will produce a single downloadable file containing the code for all ECUs processors. The division of application functionality between processors within the ECUs is determined by the model designer, and is controlled through the layout of the Simulink model.

Simulink Model Layout

A standard template Simulink model is provided for each target which shows the top level layout required for that target. The system is divided down into processor applications in each ECU through the model hierarchy. This is illustrated in the adjacent image, which shows one application (TAG310App1) divided across two processors (AP and CP) in a single ECU. For each processor the division of code between task rates is handled through the allocation of sample times to the Simulink blocks.

At the top level of the model a setup block is provided which contains information needed during code generation, such as the application version number, and definitions of inter application and inter processor memory areas.

Platform Support Packages

For each supported MES target system, a Platform Support Package is available which provides the necessary files to tailor the GDE for that system, an example top level model, and blocks to support target specific features

Requirements

Matlab R2008a to R2010b, with the following Toolboxes:

- Simulink
- Real-Time Workshop
- Real-Time Workshop Embedded Coder
- Stateflow (optional) + Stateflow Coder

Or Matlab R2011a or later with the following Toolboxes:

- Simulink
- Simulink Coder

- Embedded Coder
- Stateflow (optional)

C compiler as required for the target platform (details available on request).

vTAG vTAG

The vTAG simulation environment forms part of the integrated data analysis systems provided by McLaren Electronics.

vTAG provides the framework to support the execution of model based embedded code on PC based hardware. The entire system application code can be auto-generated from models developed with tools such as Simulink and Dymola.

vTAG applications can be used in the vTAGserver environment to analyse and enrich the data received from embedded control units.

In the vTAG-310 environment entire systems can be modelled allowing Software-In-The-Loop (SIL) development of control systems.

In the vTAG-RT environment vTAG applications are run in hard realtime allowing creation of Hardware-In-The-Loop (HIL) test equipment and vehicle simulators.

In Detail

Features

- Simulation and code generation environment
- Configuration of system using System Monitor
- Logging of data using ATLAS
- Integration with ATLAS client allowing processing of existing data
- Integration with ATLAS DataServer allowing enrichment of telemetry data stream to clients
- Multithreading system allows utilisation of multi-core processors

Environments

- vTAGserver – Offline processing of logged data. Real-time processing of live telemetry data
- vTAG-310 – Windows PC based simulation of entire systems
- vTAG-RT – PC hardware running RTOS for hard realtime simulation

vTAG Kernel

The vTAG Kernel provides the core executable for the system. It provides the equivalent of an embedded system's boot code, and provides basic Ethernet communications for connecting to System Monitor. The vTAG kernel runs inside the vTAG-310 Windows application, or within the ATLAS vTAGserver in-place control. In vTAG-RT the kernel runs directly on

the target system under the RTOS.

vTAG BIOS

The vTAG BIOS provides all the communication, task scheduling and logging for the system. Up to nine vTAG applications may be run by the BIOS. To take advantage of PCs with multiple processor cores the BIOS allows each application to run in a separate thread.

Logging at rates up to 1kHz is provided. The signals to be logged are selected using System Monitor and may be logged at different rates in each of eight channels. Channel start/stop triggers can be configured individually allowing complex event based multirate logging of signals.

vTAG Applications

vTAG applications can be built from Simulink models using GDE 8.2 with the vTAG Platform Support Package. This allows Simluink models to be built into code that is tailored to running on the vTAG system. Other platform support packages are available to allow code to be built for real ECUs. The same models can be used on either vTAG or real ECUs with minimal changes.

To build applications using Dymola the Dynamic Model Integrator (DMI) is used and is capable of using Dymola's code export or binary export capabilities

Interapplication Communications

vTAG applications can communicate with each other by several methods:

Shared Memory several shared memory areas can be defined to allow applications to read/write from common predefined areas.

External Reference using GDE 8.2's Measurement Read blocks implicit connectivity can be achieved. At initialisation for any signal Measurement Read block which does not have a corresponding write block in that application, the BIOS will search the other applications for that signal and use it if found.

Development Products

For Simulink vTAG-310/vTAGserver applications

- GDE 8.2
- vTAG Platform Support Package

For Dymola vTAG-310/vTAGserver applications

- Dynamic Model Integrator (DMI)
- Visual C++ Express (2005/2008)

For vTAG-RT applications the vTAG-RT extension must be specificed in addition. If DMI and GDE are used on a single PC, then only one vTAG-RT extension is required for both.

Runtime Products

For vTAG-310

- ATLAS
- System Monitor
- vTAG-310

For vTAGserver (local client processing only)

- ATLAS
- System Monitor
- vTAGserver

For vTAGserver (live data processing)

- ATLAS
- ATLAS DataServer
- ATLAS VTS recorder
- System Monitor
- vTAGserver

For vTAG-RT

- System Monitor

Get in touch to find out more about how McLaren Applied Technologies can meet your motorsport needs and exceed your expectations.

Please email **sales@mclaren.com** or telephone **+44 (0) 1483 261400** for the UK and worldwide or **+1 704 660 3181** for the United States.