150 SERIES ENVIRONMENTAL & METEOROLOGICAL MONITORING

T +44 20 8551 7000
E INFO@MUNROINSTRUMENTS.COM
W WWW.MUNROINSTRUMENTS.COM

MUNRO
INSTRUMENTS

CONTENTS

ABOUT **MUNRO** INSTRUMENTS

Munro Instruments Ltd is based in London, UK. Founded in 1864, the company has designed and manufactured innovative products for a range of industries. It operates across two core product lines: meteorological/environmental monitoring and occupational health.

The company's exceptional versatility has been key to its longevity. Since its founding, Munro Instruments has established a truly global reputation, having supplied equipment to meteorological offices, civil aviation authorities, government organisations, ports, harbours and offshore rigs around the world. Its equipment is used for general weather monitoring, climate modelling, health-and-safety purposes, and to support other applications in agriculture, telecommunications, defence, aviation etc.

It is becoming increasingly important to understand the ways in which the weather affects our everyday activities. As such, our current focus is on broadening the scope and availability of environmental monitoring equipment. We enable users to engage with their surroundings and develop effective strategies to boost efficiency and promote safety – whatever the application or industry.

Munro Instruments remains a bastion of British manufacturing and is committed to its reinvigoration. High quality materials and outstanding workmanship have enabled consistent production of reliable, accurate and durable instrumentation.

INTRODUCING **THE 150 SERIES**

Bespoke Environmental & Meteorological Monitoring Systems

The Munro 150 Series is an innovative new approach to environmental and meteorological monitoring. The Series encompasses a large range of sensors, data loggers and power supplies, from which users can freely select to create a monitoring system suited exactly to their needs budget and application – from small single-sensor installations to large networks of Automatic Weather Stations (AWS).

The 150 Series' modular, build-your-own approach permits absolute flexibility. Users have total control over which parameters they measure and how data is transmitted and received.

Sensors are available to measure:

- **Wind Speed & Direction**
- **Rainfall**
- **Temperature & Humidity**
- **Barometric Pressure**
- **Solar Radiation**
- **Lightning**
- **Cloud**
- **Soil Quality**
- **Water Quality**
- **Air Quality**

All sensors are professional-standard and/or WMO-compliant and are easily configurable with one (or more) of our three data loggers. These have been carefully designed to satisfy even the most demanding of applications. The sensors and data loggers can, in addition, be powered independently using sustainable means (using a Munro wind turbine or solar panel). This means that 150 Series systems can be deployed remotely and left completely unattended.

Masts of varying heights are also available, allowing for easy set-up, maintenance and dismantling.

All 150 Series Systems are 'plug and play'. They are built and configured in-house and delivered to the customer ready to use. Additional sensors can be added a later date if required.

APPLICATIONS

AGRICULTURE

AVIATION

MARINE & OFFSHORE

METEOROLOGICAL
& ENVIRONMENTAL AGENCIES

MILITARY

RENEWABLE ENERGY

ROAD & RAILWAY

AGRICULTURE

Agricultural production is heavily reliant on inputs from the natural environment (e.g. sunlight and rainfall). Farmers must carefully plan their activities based on seasonal changes in the weather. This allows them to manage the growth and harvest of crops.

Onsite monitoring of weather and climate can assist in the implementation of enhancement strategies. Farmers can optimize processes (such as crop spraying, irrigation and care of livestock) and configure alarms to warn of high winds, low temperatures and heavy rainfall.

Fluctuations in the environmental conditions – as a result of climate change and other unforeseen weather events – can also have a catastrophic effect on productivity and livelihood. Accurate knowledge of the weather and climate is essential, as it helps inform long- and short-term decision-making.

Munro sensors enable the measurement of all relevant agrometeorological parameters. These include wind speed and direction, temperature, humidity, rainfall, solar radiation, soil quality and water quality. Sensors can be deployed remotely without the need for mains power. Data is accessible using our online software. It is displayed in a clear, easy-to-understand format and can be used to derive additional calculations such as evapotranspiration and wind chill.

AVIATION

Accurate meteorological information is an essential part of airport safety operations.

Our 150 Series allows users to create fully flexible automatic weather stations. These can be designed to meet the needs of individual airports and aerodromes and, where necessary, can be configured in line with ICAO & WMO guidelines.

Our sensors provide real-time information on a large number of parameters (detailed below). Up-to-the-second data ensures airport personnel have the necessary information to make critical decisions. This helps to maintain smooth, safe and efficient flight operations.

Wind Speed & Wind Direction: Our comprehensive range of anemometers allow for accurate measurement of wind speed and direction at single or multiple sites. Derived parameters, including maximum gust and wind speed/direction variability, can also be reported.

Air Temperature, Dew point & Relative Humidity: To meet requirements for temperature, relative humidity and dew point observations, we offer a complete selection of hygrometers.

Barometric Pressure: We supply barometric sensors capable of reporting QNH (pressure adjusted to sea level) and QFE (pressure adjusted such that the altimeter will read zero upon landing).

Visibility & Runway Visual Range (RVR): Using a light scattering technique Visibility, Meteorological Optical Range (MOR) and RVR are measured and reported in m/km

Rainfall: We offer a number of different tipping bucket rain gauges, suitable for use in a range of environments.

Present Weather: Our Present Weather Sensor reports precipitation type (drizzle, rain, snow, freezing rain, haze, mist fog etc.) according to the World Meteorological Organization (WMO) Table 4680 Codes.

Cloud & Sky Condition: Our Ceilometer provides a precise assessment of sky condition with measurement of cloud base height, amount and type.

Any number and combination of sensors can be selected and paired with our powerful data logger. Collected data is then automatically transmitted via 3G, UHF radio frequency or Zigbee wireless to our cloud-based software. This powerful software, accessible anywhere, provides a platform for data storage, visualisation and manipulation. It is also possible to configure alarms within the software to notify relevant parties if specified thresholds are breached.

MARINE & OFFSHORE

Offshore operations are highly susceptible to the vagaries of the weather. With only limited access to emergency response services, effective safety management is critical to prevent injury and loss of life.

Gale force winds, icing and heavy rain can make working conditions treacherous, particularly in the presence of heavy machinery. On oil platforms and drillships, all personnel must adhere to strict guidelines to avoid calamity. Operators of cranes, supply vessels and helidecks are particularly vulnerable and, in extreme weather, may have to cease activities completely.

Equally dangerous, particularly in the oil and gas sector, is the risk of exposure to flammable and toxic gases. Gas and particulate sensors can help to pinpoint contaminated areas, as well as monitor general emissions.

Routine observation of air quality, wind speed and direction, rainfall, temperature, humidity and barometric pressure can help to streamline offshore operations by ensuring best use of staff and equipment. This will increase productivity and minimize the risk of accidents.

Munro offers a large range of rugged meteorological and environmental sensors suitable for use offshore. If necessary, all can be powered independently using a solar panel or wind turbine, thereby dispensing with the need for cable. Data is accessible via our clear, easy-to-use software. Users can derive additional parameters, such as wind chill and evapotranspiration, if necessary. Alarms are configurable for when unsafe levels are breached. Additional displays and alarms can be located at key vantage points (e.g. in crane cabins or helidecks). All historical data is stored and is easily downloadable for reporting and/or investigative purposes.

METEOROLOGICAL & ENVIRONMENTAL AGENCIES

All people and industries are affected by the weather in some way. It is both an ally and our greatest adversary. The task of meteorologists is to monitor, analyse and understand the behaviour of weather and climate. Only by doing so can we develop effective counter-strategies. Proper meteorological management can help businesses and individuals to save time and money, boost efficiency and promote safety. It also plays an essential role in the mitigation of the impacts of natural disasters.

Continuous monitoring of environmental phenomena is required not only for small-scale observations but also to assist in the creation of forecasts, climate models and early-warning systems. Different spatial and temporal resolutions must be considered in order to generate an accurate picture of local, regional and global weather systems. This, in turn, can help decision-makers overcome dangerous situations and ensure maximum safety and efficiency.

The collection and analysis of weather data can be carried out manually or, where sites are too remote or inconvenient for regular attendance, automatically. With over 150 years' experience, Munro Instruments has achieved a reputation for excellence in providing instruments and systems to measure environmental phenomena. The company's longevity has given it a unique insight into the needs and workings of the meteorological industry.

Our latest project, the Munro 150 Series, comprises a range of fully automated telemetric weather sensors. Users can freely select any number of sensors across all meteorological parameters to create their own bespoke weather station. It is suitable for all applications and can be deployed remotely in difficult-to-access areas. Data is exported to our software, where it can be viewed and analysed anywhere in the world. The sensors can be networked and configured remotely.

MILITARY

All military procedures – whether on land, at sea or in the air – require meticulous planning. Routine observation and forecasting of the weather is vital to ensure the smooth-running of everyday operations. Troop welfare, ballistics and the navigation of planes and ships are all highly dependent on it. Unforeseen natural events can affect strategic manoeuvres and endanger the lives of personnel.

Munro Instruments offers a range of sensors, data loggers, masts and tripods. All are highly versatile and can be integrated in any combination to meet the requirements of even the most demanding application. Monitoring stations can be designed for permanent installation – e.g. at a field base or airport – or rapid deployment in the field. The sensors are easy to maintain and communicate data in a way that is quick and easy to understand.

ROAD & RAILWAY

Up-to-date information on weather conditions are a vital input to the safe and smooth operation of road and railway systems. In particular, surface vehicles are significantly affected by precipitation, strong winds, flooding, ice-formation and poor visibility.

Through real time measurement of meteorological parameters, it is possible to take precautionary measures to reduce the impact of the weather on the efficiency and safety of road/rail transport.

Munro Instruments supplies a range of sensors and data loggers to keep Highway Authorities and Railway Companies up to speed on environmental conditions. Please get in touch to discuss your individual requirements.

RENEWABLE ENERGY

Renewable energy helps to enliven economies, increase productivity and save lives. As demand for electricity increases, so too does the need for energy security. In addition to its environmental impact, continued reliance on fossil fuels leaves economies exposed to price fluctuations and cross-border supply issues. Technological advances in the renewable sector have improved efficiency and reduced costs, helping to restore faith in the clear energy market.

Munro Instruments strongly supports advances in renewable energy and has made this sector a priority for the coming years. We have devised a number of specific measurement solutions for the solar and wind energy markets. Our extensive range of sensors can

be used to conduct wind resource assessments and detailed studies into the photovoltaic (PV) product life cycle – from cell research, development and production to site prospecting and performance monitoring. These systems are designed to combine measurement precision with end-user simplicity. Once installed, sensor measurements are sent wirelessly to our web-based software. This allows users to access and analyse the data anywhere in the world. Power curves and other derived calculations, such as gusts and wind speed averages, can be configured to appear automatically, enabling operators to make quick, accurate and informed decisions.

BUILD YOUR OWN SYSTEM

We wanted to make the process of configuring your meteorological and environmental monitoring station as simple as possible. To build your system, simply follow the steps detailed below, selecting sensors, data loggers, power supplies and accessories to meet your requirements.

If you are in need of individual components/sensors, that's not a problem. Simply let us know your requirements. **We are happy to help.**

Sensors

Power Supply

Your System

Data logger

Mast

Software
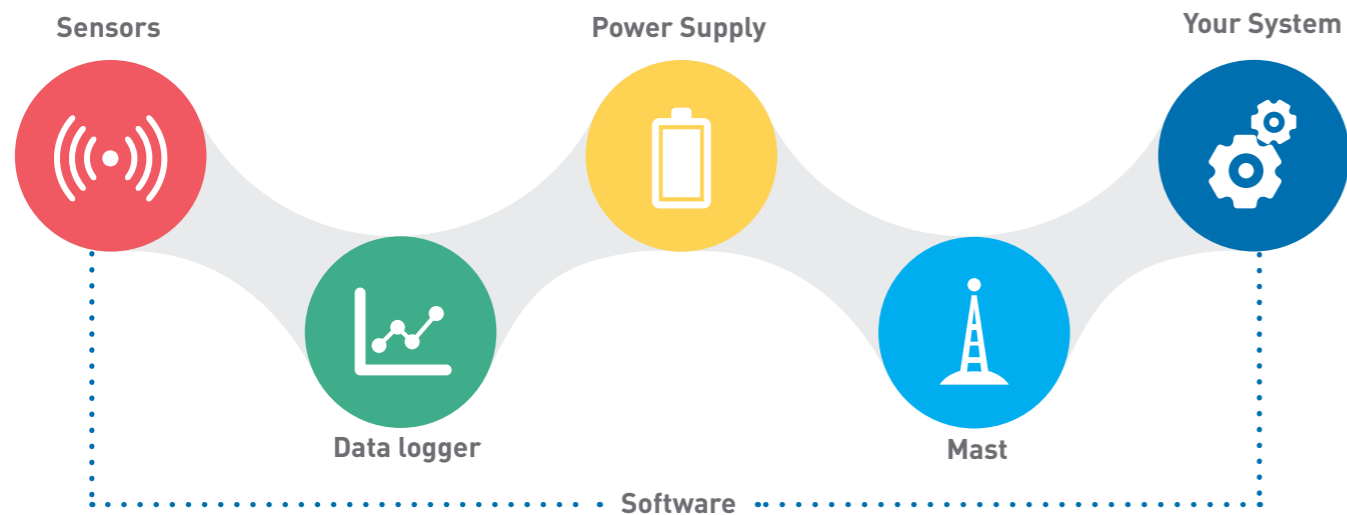
PRODUCTS

WIND SPEED & DIRECTION

Regular measurement of wind speed and direction is an essential requirement of meteorological stations. This information is used for general forecasting and to make longer term weather predictions.

Elsewhere, knowledge of wind speed and direction is vital for airports, marine authorities, civil engineers, agriculturists, sport and outdoor event promoters and tour operators (among others).

As one of the earliest manufacturers of the Robinson Cup Anemometer (1870), Munro Instruments has maintained a special interest in the field of wind speed and direction. Our equipment is highly durable and provides an absolute assurance of accuracy

150/IM147 IN-LINE CUP ANEMOMETER AND VANE

Product Description
Munro's flagship wind speed & direction sensor is a dual in-line unit, comprising an IM124 Cup Anemometer and an IM145 Wind Direction Vane. By virtue of its accuracy and durability, it has become one of the world's most widely distributed wind sensors, having served meteorological offices, airports, offshore rigs, power stations, ports and harbours worldwide for over fifty years.

Its rugged, corrosion-resistant design means that it is fully operable even in the most adverse of environments, including heavily salt-laden atmospheres and lightning-prone areas. The system requires little to no maintenance and can be powered independently using sustainable methods. This means the sensor can be deployed remotely and left completely unattended.

Wind Speed Sensor
The IM124 Cup Anemometer is a self-powered, electro-mechanical unit, capable of measuring wind speeds of up to 180 Knots (equivalent to 200 mph, 90 m/s and 320 km/h). The rotor turns within a fixed stator coil assembly, producing an AC current which varies with the speed of the rotor. This generates an output voltage which is proportional the the wind speed. The unit is non-directional. The IM124 is available as a stand-alone unit.

Wind Direction Sensor
The IM145 Wind Direction Vane is a sensitive yet robust element, employing a magnetic encoder to give high accuracy wind direction measurements.

Technical Specifications

Specification	Description
Wind Speed Range	0-90 knots / 0-180 knots Full Scale Range (F.S.)
Wind Speed Accuracy	±1 knot < 40 knots, ±2 knots > 41 knots
Wind Speed Resolution	1 knot
Wind Speed Start Threshold	4±1 knots
Anemometer Dimensions	267 mm (Height), 228 mm (Axis to Outer Cup Edge), 127 mm (Cup Diameter)
Anemometer Weight	4.2 kg
Wind Direction Range	0-360°
Wind Direction Accuracy	±1°
Wind Direction Resolution	1°
Wind Direction Start Threshold	3±1 knots
Wind Vane Dimensions	585 mm (Height), 790 mm (Axis to Fin Tip), 375 mm (Axis to Balance Weight)
Wind Vane Weight	12 kg
Operating Temperature	-40°C to +100°C
Power Consumption (wind direction)	10 mA
Power Supply	Mains or 16/32/64 Ah Lithium Ion Battery 3.6 V or 50/100/200 Ah Rechargable Battery or External Sustainable Energy Supply

150/W10 **3-AXIS** ULTRASONIC ANEMOMETER

Product Description

This 3-axis ultrasonic anemometer provides highly accurate measurements of the wind speed & direction, U-V-W Cartesian components of speed, sound speed and sonic temperature. Its rugged construction allows environmental conditions to be monitored even in the most extreme conditions.

This instrument can also be supplied with integrated sensors to measure temperature, relative humidity and pressure (please state if this functionality is required when requesting a quotation).

Additional features of this product include:

- No moving parts
- Low power consumption
- User-configurable averaging periods
- Self-diagnosis capability with error checking and reports
- Automatic alignment to North through built-in compass
- Range of digital and analogue outputs including RS232 and 4-20mA

This anemometer is also available with an inbuilt heater to prevent the formation of snow and ice.

Technical Specifications

Specification	Description
Wind Speed Units	m/s, cm/s, km/h, knots, mph
Wind Speed Range	0-70 m/s
Wind Speed Resolution	0.01 m/s
Wind Speed Accuracy	±1% of reading
Wind Direction Range	Azimuth 0-360°, Elevation ±60°
Wind Direction Resolution	0.1°
Wind Direction Accuracy	±1°
Sound Speed Range	300-380 m/s
Sound Speed Resolution	0.01 m/s
Sound Speed Accuracy	±1% of reading
Sonic Temperature Range	-40ºC to +60ºC
Sonic Temperature Resolution	0.1ºC
Sonic Temperature Accuracy	±1ºC
Compass Range	0 to 360º
Compass Resolution	0.1º
Compass Accuracy	±1º
Digital Outputs	RS232, RS422 full duplex and multidrop RS485
Analogue Outputs	0-20mA, 4-20mA, 0-5V, 1-5V, 0-10V, 14 bit resolution
Power supply	12-30 VDC
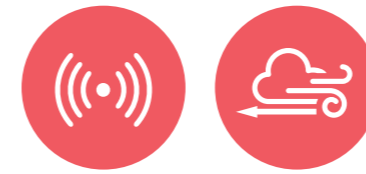
150/W20 **2-AXIS** ULTRASONIC ANEMOMETER (0-60 M/S)

Product Description

This durable 2-Axis Anemometer facilitates the measurement of wind speed & direction and the U-V Cartesian components of wind speed. Operating according to the ultrasonic principle, it is unaffected by inertia and can therefore detect extremely low wind speeds to a high degree of accuracy.

The sensor requires a 10-30 VDC power supply, making it particularly suitable for remote applications. As it contains no moving parts, this ultrasonic anemometer can be left for up to two years without the need for maintenance or re-calibration. Furthermore, the sensor has a very small power draw. It is therefore ideal for remote solar-powered or wind-powered systems.

This lightweight sensor can be fitted to any 40 mm diameter pole/mast. The inbuilt compass makes installation and alignment quick and easy.

The sensor has a temperature operating range of -40ºC to +60ºC. Optionally, it can be fitted with a heater to prevent the accumulation of ice and snow in low temperatures.

The sensor outputs can either be analogue 0-1 V, 0-5 V, 4-20 mA. Alternatively, the serial outputs are RS232 and RS 485 following communication protocols SDI-12, MODBUS or NMEA.

This instrument can also be supplied with integrated sensors to measure temperature, relative humidity, barometric pressure and solar radiation (please state if this functionality is required when requesting a quotation).

Technical Specifications

Specification	Description
Wind Speed Range	0-60 m/s
Wind Speed Resolution	0.01 m/s
Wind Speed Accuracy	±2% (<35 m/s), ±3% (>35 m/s)
Wind Direction Range	0-359.9º
Wind Direction Resolution	0.1º
Wind Direction Accuracy	±2º
Power Supply	10-30 VDC
Power Consumption	26 mA @ 12 VDC
Analogue Outputs	0-1 V, 0-5 V, 4-20 mA
Digital Outputs	RS232, RS485, SDI-12, MODBUS-RTU
Operating Temperature	-40ºC to +60ºC
Environmental Protection Rating	IP66

150/W30 **2-AXIS ULTRASONIC ANEMOMETER (0-30 M/S)**

Product Description

This 2-Axis Ultrasonic Anemometer is a rugged, professional-grade sensor, providing high-accuracy wind speed and direction measurements. It also reports air temperature, maximum gust speed and the average vector components of the wind.

As there are no moving parts, the instrument is not subject to any physical constraints. It has a start threshold of 0 m/s and is capable of detecting even the tiniest variation in the wind's behaviour. It is lightweight, easy to deploy and requires no maintenance or calibration.

The anemometer works by emitting acoustic resonances from one side of the unit to the other. The wavelength changes according to the speed and direction of the wind, and this information is mathematically processed to give an accurate reading.

The anemometer has a 3.5 mm stereo plug connector, which can be used with a number of different data loggers. It communicates via SDI-12 protocol.

Owing to its size, portability and low power output, the anemometer can be left on its own in inaccessible locations for long periods of time. Data can be collected and monitored remotely.

This 2-Axis Ultrasonic Anemometer is extremely versatile and is suitable for most meteorological and hydrological applications. Other uses include: agriculture, forestry, urban environmental monitoring, tunnel and bridge infrastructure, irrigation scheduling and watershed characterization.

Technical Specifications

Specification	Description
Wind Speed Range	0-30 m/s
Wind Speed Resolution	0.01 m/s
Wind Speed Accuracy	0.3 m/s
Wind Direction Range	0 to 359º
Wind Direction Resolution	1º
Wind Direction Accuracy	±3º
Operating Temperature Range	-40ºC to 50ºC
Excitation Voltage	3.6 to 15 VDC
Current	0.03 mA quiescent, 0.5 mA sampling, <0.05 mA average
Diameter	100 mm
Height (Wind Sensor)	75 mm
Height (Total with Mount)	155 mm
Maximum Sampling Speed	1Hz
Output	Average speed, direction, gust or vectors (SDI-12)

PRECIPITATION & **PRESENT WEATHER**

Regular rainfall measurement is an essential requirement in many aspects of agriculture, forestry, industry, education and other activities.

Rainfall is rarely uniform in intensity or duration across a wide area. As such, continuous data on local conditions is of particular importance to farmers and those concerned with irrigation, scientists researching crop performance and soil erosion, and to water and river authorities in respect of reservoir supplies and ground water feeding into rivers.

Munro offers a range of precision rain gauges, many built to a British Meteorological Office or World Meteorological Organization (WMO) specification, ensuring accurate rainfall collection and measurement.

We are also pleased to offer a state-of-the-art Present Weather Sensor for use in situations where visibility measurements and automatic detection of precipitation type (fog, haze, drizzle etc.) are required.

150/R100 **TIPPING BUCKET RAIN GAUGE**

Product Description

The 150/R100 Tipping Bucket Rain Gauge can be used with a data logger, counter or event recorder. This makes it ideal for remote monitoring and recording, or network integration.

How the Tipping Bucket Rain Gauge Works

The principle underlying the Tipping Bucket Rain Gauge is well proven and ensures accuracy with unlimited capacity.

The bucket is divided into two parts and mounted on a tungsten axle and pivots. When one part fills, the bucket tips to discharge the water to the ground and also activates a pair of switches. The other part of the bucket then fills and the cycle is repeated for as long as rain is falling. A wire mesh filter prevents the ingress of debris or insects.

A deep cover option is available, with the funnel set 127 mm below the rim to prevent rain bouncing out during sudden downpours. Please specify your requirements when requesting a quotation.

Technical Specifications

Specification	Description
Diameter of Aperture	203 mm
Area of Aperture	32365 mm²
Rainfall Capacity	Unlimited
Base Diameter	280 mm
Height (Standard Cover)	310 mm
Weight (Standard Cover)	5.8 kg
Height (Deep Cover)	437 mm
Weight (Deep Cover)	7.0 kg
Calibration	0.2 mm per tip
Measurement Output	Digital Pulse

150/R40 **SNOW & RAIN GAUGE**

Product Description

This rain gauge, available with or without heating, measures precipitation and snowfall in a copper funnel. Water is led into the self-emptying single-spoon Polyoxymethylene (POM) tipping bucket, which is held in place by a hard ferrite magnet. The magnet will exert just enough tension to empty the measuring bucket in one quick movement (less than 300 ms). It will then return to its original position, ready once again to collect preciptation. Use of a single spoon allows for easy calibration, as only one adjustment screw is required.

- Meets World Meteorological Organization standards (WMO guide no. 8)
- Deep funnel to avoid splash-out and evaporation
- 200 cm² orifice (sharp-edged top ring)
- Drain pipe for collection of precipitation
- Plastic drip-rod/filter

- Thermal safety switches on the heating elements (if applicable) to avoid evaporation and reduce power consumption
- Two separate heating compartments (if applicable)

The outer shell is made of Styrosun, which is highly durable and easy to clean. The PCB is also protected against extreme weather conditions (frost and heat) and is also suitable for use in heavily salt-laden environments.

These rain gauges are extremely versatile and are suitable for use in weather stations, avalanche facilities, road authorities, skiing resorts, water works, waste-water treatment plants and hydropower stations. They can be customized to suit individual needs. Please specify your requirements when requesting a quotation.

Technical Specifications

Specification	Description
Orifice	200 cm²
Diameter	159.6 mm
Total Height	420 mm
Splash Room Height	255 mm
Weight	2.1 kg
Resolution	Choose from 0.1 mm, 0.2 mm, 0.25 mm, 0.5 mm
Max Deviation at 12 tips/minute	±2%
Top Ring	60°
Temperature Control	Funnel compartment: 3±1°C, Registration compartment: 22±1°C
Safety	Controlled Thermostat
Power Supply	100-230 VAC / 50-60 Hz
Output Regulation	24 VDC ±5% (max power)
Measurement Output	Digital Pulse

150/R10,150/R20,150/R30 **PROFESSIONAL, TOWER & MINIATURE RAIN GAUGE**

150/R10

150/R20

150/R30

Product Description

Our Professional, Tower and Miniature Rain Gauges have been designed to meet the needs of a specific group of users:

- **150/R10 Miniature Rain Gauge** – This miniature tipping bucket rain gauge is suitable for both professional and personal use (on farms, construction sites, gardens, schools, sports facilities, highway agencies etc).

- **150/R20 Tower Rain Gauge** – This compact self-emptying tipping bucket rain gauge is suitable for all small weather station applications (in schools, gardens, farms, construction sites, sports facilities, highway agencies etc).

- **150/R30 Professional Rain Gauge** – Owing to its strength and versatility, this rain gauge has become an industry standard for precipitation measurements. It is used extensively in meteorological and hydrological stations around the world, as well as wastewater plants and hydroelectric power stations. It is also suitable for use in agriculture, construction, military, engineering and forestry.

Each of these three rain gauges works by means of a tipping bucket. Precipitation enters the funnel and is led into a self-emptying bucket. This is held in place by a hard ferrite magnet. The magnet exerts just enough tension to empty the measuring bucket in one quick movement (less than 300 ms). It then returns to its normal position, ready once again to collect precipitation. The bucket itself is made from Polyoxymethylene (POM) and is therefore resistant to dust and dirt deposition. This maximises effective water release.

The outer shell of each rain gauge is made of Styrosun, which is highly durable and easy to clean. These rain gauges are suitable for use in extreme weather conditions, including heavily salt-laden environments. They are also frost proof.

A variety of connection cables for use with these rain gauges are available to meet user requirements. These include binder connectors, jack plug and two-pole connections.

Technical Specifications

Specification	150/R10 Miniature	150/R20 Tower	150/R30 Professional
Orifice	50 cm²	50 cm²	200 cm²
Resolution	1 mm (±0.5%)	1 mm (±0.5%)	0.1 mm, 0.2 mm, 0.25 mm, 0.5 mm
Total Height	10 cm	10 cm	255 mm
Weight	118 g	118 g	380 g
Measurement Output	Digital Pulse	Digital Pulse	Digital Pulse

150/R-SWS-250 **VISIBILITY & PRESENT WEATHER SENSOR**

Product Description

This Visibility & Present Weather Sensor is ideally suited for use in aviation applications, where visibility and present weather measurement is required.

Using a 45° forward scatter angle and 850 nm infrared light source, visibility is given in terms of Meteorological Optical Range (MOR), Atmospheric EXtinction COefficient (EXCO) and Transmissometer equivalent EXCO (TEXCO) output.

Present weather is reported using World Meteorological Organization (WMO) 4680 code table (e.g. fog, drizzle, rain etc.). This sensor incorporates a backscatter receiver which, used in conjunction with sophisticated algorithms, ensures identification of liquid and frozen precipitation with extreme accuracy.

The optical windows of the sensor are fitted with low power heaters. This prevents the formation of condensation, thus safeguarding the accuracy of visibility measurements. Further, in the event that the window becomes contaminated through dirt build-up, the sensor issues a user-warning. This means cleaning can be promptly arranged to prevent interference with measurement outputs.

In cold environments, the sensor hoods can be fitted with heaters. These operate when the temperature drops below 4°C to ensure that blowing snow does not obscure the optical path. Please advise if this functionality is required when requesting a quotation.

Technical Specifications

Specification	Description
Measurement	Visibility (MOR, EXCO & TEXCO) & Present Weather (According to 39 WMO Table 4680 Codes)
Measurement Principle	Forward scatter 45°
Measurement Error	5% at 1,500 m
Serial Output	RS232, RS422 or RS485
Sensor Power	9–36 VDC (6 W)
Hood heating power	24 VAC or DC (36 W)
Operating Temperature	-40°C to +60°C
Operating Humidity	0–100% RH
Environmental Protection rating	IP66/IP67
Weight	3.5 kg

TEMPERATURE & HUMIDITY

Temperature and humidity sensors are an integral part of most environmental and meteorological monitoring stations. Data is collected for synoptic and climatological purposes and to assist in the creation of weather forecasts. This information is crucial to support the activities of governments and certain industries such as agriculture and tourism.

In the workplace, routine observation of temperature and humidity helps to maximise comfort, health and wellbeing. Inadequate control of ventilation, heating and refrigeration units can lead to a loss of productivity and efficiency. Animal and plant enclosures are equally vulnerable to temperature fluctuations and must also be carefully monitored to prevent suffering or loss of life.

Munro Instruments offers a range of sensors to enable the measurement of temperature, relative humidity, vapour pressure and dew point. These instruments can be used alone as single-sensor installations, or as part of a multi-sensor automatic weather/environmental monitoring station.

150/T10 PRECISION HYGROMETER

Product Description

This highly precise hygrometer is an excellent solution for those who need to monitor humidity and temperature.

Humidity is measured by a capacitative sensor made up of a hygroscopic polymer. The sensor works by detecting changes in the dielectric constant, which is directly proportional to the relative humidity of the surrounding environment. The advantages of this type of sensor include insensitivity to temperature changes, quick response time and durability.

The temperature sensor is a platinum resistance thermometer (100Ω at 0°C). The Pt100 resistance variation is transformed into a current or voltage signal, linear to temperature.

Technical Specifications

Specification	Description
Humidity Sensor Type	Capacitive Hygroscopic Polymer
Humidity Measuring Range	0-100% RH
Humidity Accuracy	±0.15% (0-90% RH)
Humidity Sensor Working Temperature	-40°C to +60°C
Hysterisis and Repeatability	0.4% RH
Long Term Stability	1%/ year
Response Time at 63% of Final Variation	3 minutes with filter, 6 seconds no filter
Temperature Sensor Type	4 wire Pt 100 1/3 DIN
Temperature Measurement Range	-40°C to +60°C
Temperature Accuracy	±0.15ºC, ±0.1% of measurement
Temperature Stability	0.2°C/ year
Outputs	Analogue: 4-20 mA; Digital: RS232 or RS485 MODBUS RTU
Power Supply	10-40 VDC
Consumption	2 mA
Environmental Protection Rating	IP65

150/T20 **PROFESSIONAL HYGROMETER**

Product Description

This compact, rugged hygrometer provides accurate measurements of relative humidity, air temperature, vapour pressure and barometric pressure. It is supplied with a radiation shield to protect it from dust and liquid, whilst ensuring adequate airflow to the sensor. For indoor monitoring applications, use of the radiation shield is not critical, providing the sensor is not exposed to solar radiation or other direct sources of heat.

The instrument comprises both a capacitance humidity sensor and a bandgap temperature sensor.

Measurements are taken simultaneously and are used to calculate the vapour pressure. Barometric pressure is measured using a secondary sensor chip.

The hygrometer responds quickly to changes in the temperature and humidity and has very minimal long-term drift. It is recommended that the sensors are calibrated at least once every two years to ensure continued accuracy.

Technical Specifications

Specification	Description
Humidity Resolution	0.1% RH
Humidity Range	0-100% RH
Temperature Resolution	0.1°C
Temperature Range	-40°C to 80°C
Vapour Pressure Resolution	0.01 kPa
Vapour Pressure Range	0-47 kPa
Barometric Pressure Resolution	0.01 kPa
Barometric Pressure Range	49-109 kPa
Sensor Type	Digital capacitance and bandgap temperature sensor
Output	SDI-12
Operating Environment	-40°C to 80°C
Cable Length	5 m
Power Requirements	3.6 to 15 VDC 0.03 mA quiescent, 4 mA during 300 ms measurement
Long Term Drift	0.04°C/ year

BAROMETRIC **PRESSURE**

Atmospheric pressure describes the force exerted on a surface by the air. This can vary depending on a number of factors, including the altitude, the temperature and the composition of gases that make up the air.

It is an essential parameter for forecasters, as it enables early detection of weather changes. Knowledge of atmospheric pressure is also useful in a number of other contexts: e.g. when working at altitude, underground or in specially controlled environments, and for understanding the behaviour of air pollution.

Munro Instruments provides a comprehensive range of sensors to enable the accurate measurement of barometric pressure.

150/B10 **BAROMETRIC PRESSURE SENSOR (500-1200 hPA)**

Product Description

This Barometric Pressure Sensor uses a high-accuracy temperature-compensated piezoresistive silicon sensor. It gives precise measurements of atmospheric pressure in the range 500 hPa to 1200 hPa.

With an integrated temperature element, the sensor offers excellent thermal stability, providing consistent results across the entire operating temperature range (-40°C to +85°C).

It is suitable for all indoor and outdoor applications (e.g. clean rooms, internal combustion engines, laboratories)

and can be used as a stand-alone sensor or as part of a larger environmental monitoring system with other sensors from the Munro 150 Series.

Housed in an IP67 enclosure, the sensor is ideal for remote applications. It requires very little power (10-30 VDC) and can be powered by solar cells. It communicates via SDI-12 protocol, allowing for data transmission across large sensor networks.

Technical Specifications

Specification	Description
Sensor Type	High-accuracy piezoresistive silicon sensor
Measurement Range	500-1200 hPa
Resolution	0.01 hPa
Accuracy	± 0.4 hPa, in the entire temperature operating range -40°C to +85°C
Digital Output	RS485 and RS422 (with MODBUS-RTU and NMEA protocols), RS232 (with standard NMEA protocol), SDI-12. Please specify.
Analogue Output	0-5 V, 1-5 V, 0-20 mA, 4-20 mA
Long Term Stability	0.25 hPa/year
Turn on time	Approx 2 s from powering
Response Time	16 ms
Supply Voltage	10-30 VDC
Absorption Current	<10 mA for analogue or modbus measurements, 200 μA for SDI-12 protocol between measurements
Operating Conditions	-40°C to +85°C, 0-100 % RH
Media	Dry air and non-corrosive media
Overload Pressure	3 x full scale
Environmental Protection Rating	IP67

150/B20 **BAROMETRIC PRESSURE SENSOR (600-1100 hPA)**

Product Description

This Professional Barometric Sensor employs a piezoresistive silicon element. This provides an output signal that is directly proportional to the atmospheric pressure. It has excellent repeatability, temperature stability and low hysteresis.

The sensor is lightweight, transportable and can be easily secured to a panel or wall. It is housed inside a strong IP67-rated enclosure and requires a low-energy DC power supply. It comes with a static port to minimize the possibility of error caused by wind flow. It is ideally suited for remote applications.

Technical Specifications

Specification	Description
Sensor Type	Piezoresistive diaphragm
Measurement Range	600-1100 hPa / 800-1100 hPa
Digital Output	N/A
Analogue Output	4-20 mA, 0-1 VDC, 0-5 VDC
Accuracy	± 5 kPa at 20°C
Resolution	Infinite
Long Term Stability	0.25% of full scale over 6 months at 20°C
Turn on time	1 second to 99% of full scale reading
Response Time	<200 ms after pressure stabilisation
Supply Voltage	8-35 VDC
Supply Current	<4 mA
Operating Conditions	-30°C to +60°C (unheated), -40°C to +60 °C (heated)
Media	Air and dry gases only
Overload Pressure	2 bar - 30 psi
Environmental Protection Rating	IP67

150/B-MSB780X
AVIATION BAROMETRIC PRESSURE SENSOR

Product Description

This barometer is designed for use in aviation applications, where highly precise and reliable measurement is required. This barometer also calculates and reports QNH (pressure adjusted to sea level) and QFE (pressure adjusted such that the altimeter will read zero upon landing).

Additional features include long term stability of ±0.1 hPa/year, 500 to 1100 hPa measurement range and

choice of 1 to 3 transducers. Optionally, this barometer can be supplied with a touch screen display. Please advise if this is required when requesting a quotation.

The instrument is designed for use in challenging environments and is supplied in a metal IP66 enclosure. The microprocessor requires low power, making it suitable for solar-powered applications

Technical Specifications

Specification	Description
Measurement Range	500-1100 hPa
Linearity	<0.02 hPa
Hysteresis	<0.02 hPa
Accuracy @ 20°C	0.10 hPa
Total Accuracy	0.15 hPa (-50°C to +80°C)
Long Term Stability	Max ±0.1 hPa/year
Resolution	0.001 hPa
Temperature	-50°C to +80°C
Relative Humidity	0-100% RH
Overpressure	4000 hPa – No impact on calibration
Burst Pressure limit	7000 hPa
Environmental Protection Rating	IP66
Supply Voltage	5 to 35 VDC
Communications	RS232
Number of Transducers	1 to 3

SOLAR, CLOUD & LIGHTNING

With solar power becoming an increasingly vital component of the world's energy mix, the need for high precision solar monitoring equipment is now more important than ever. We supply a broad range of sensors to cover all solar-related applications, including cell research, module development, site selection, performance evaluation and meteorological observation.

Our solar sensor range incorporates the following instrument types:

Pyranometer (Secondary Standard, First Class and Second Class): Used to measure Broadband Solar Irradiance.

Pyrheliometers: A thermopile sensor used to measure Direct Normal Irradiance (DNI).

Spectroradiometers: Used as reference instruments for outdoor spectral irradiance measurements. This is useful for determining the individual properties of a light source at each wavelength.

We also supply a number of different Sun Trackers. Pyranometers and Pyrheliometers can be mounted to a Sun Tracker to enable a broader set of measurements to be taken.

In addition, Munro Instruments actively supports the measurement of a number of other sky parameters through the supply of thunderstorm detection systems and ceilometers.

150/S-MS802, 150/S-MS402, 150/S-MS410, 150/S-MS602
PYRANOMETERS

150/S-MS802

150/S-MS402

150/S-MS410

150/S-MS602

Product Description

Munro Instruments supplies a range of Secondary Standard, First Class and Second Class Pyranometers. These are suited to all applications in PV, meteorology, field research and solar radiation monitoring of global, tilted and diffuse irradiance. These Pyranometers are weather-proof and can be left unattended.
All sensors comply with ISO 9060 and WMO standards. Further information on each pyranometer can be found below:

150/S-MS802 Secondary Standard Pyranometer:
This instrument provides fast and ultra-precise measurements of solar irradiance. Its robust brass housing makes it a durable sensor, perfectly suited for use in harsh environments. The double-dome design eliminates any secondary radiation which may be generated in the outer dome. It is an industry standard for PV research and climatology studies around the world. In combination with a Sun Tracker and/or occulting ring, the Global Normal Irradiance (GNI) and Diffuse Horizontal Irradiance (DHI) can be easily measured.

150/S-MS402 First Class Pyranometer: This is a unique, multipurpose First Class pyranometer with built-in temperature control. It is also contained within robust brass housing and is therefore suitable for use in extreme environments.

150/S-MS410 First Class Pyranometer: This pyranometer is perfectly suited for sampling 10-minute averages of the solar radiative flux in horizontal or tilted configurations. It comes in a lightweight anodized aluminium housing and has a stable low TC detector. The thermopile sensor is protected from negative thermal effects by two transparent hemispheric glass domes.

150/S-MS602 Second Class Pyranometer: This is the smallest and most economical true thermopile pyranometer in the range. It is a Second Class pyranometer with outstanding low temperature dependency – a unique feature in pyranometers of this type. It is a compact, all-weather sensor, capable of measuring global solar radiation across the full solar spectrum. It can be found in many professional meteorological networks and small-scale PV sites.

All pyranometers can be supplied with an integrated ventilation system to minimize the effect of dew, rain, snow, ice and dust. Please advise if this functionality is required when requesting a quotation.

Technical Specifications

Specification	150/S-MS802	150/SMS-402	150/S-MS410	150/S-MS602
ISO 9060 Classification	Secondary Standard	First Class	First Class	Second Class
Response Time	95% < 5 sec	95% < 8 sec	95% < 18 sec	95% < 17 sec
Zero Offset - Ther. Rad. (200 W/m²)	<6 W/m²	<6 W/m²	<6 W/m²	<10 W/m²
Zero Offset - Temp. Change (5 K/hr)	<2 W/m²	<2 W/m²	<2 W/m²	<6 W/m²
Non-stability (change/year)	<0.5%	<0.5%	<1.5%	<1.7%
Non-linearity (at 1000 W/m²)	<0.2%	<0.2%	<1%	<1.5%
Directional Response (1000 W/m²)	<10 W/m²	<20 W/m²	<20 W/m²	<25 W/m²
Spectral Selectivity (0.35 - 1.5 μm)	<1%	<1%	<1%	<1%
Temp. Response (for 50°C band)	<1%	<1%	<2%	<2%
Tilt Response (at 1000 W/m²)	<0.2%	<0.2%	<2%	<2%
Sensitivity	Approx. 7 μV/W/m²	Approx. 7 μV/W/m²	Approx. 10 μV/W/m²	Approx. 7 μV/W/m²
Impedance	Approx 500 Ohms	Approx 500 Ohms	20-140 Ohms	20-140 Ohms
Operating Temperature Range	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C
Irradiance Range	0 - 4000 W/m²	0 - 2000 W/m²	0 - 4000 W/m²	0 - 2000 W/m²
Measurement Output	mV (can be converted to mA or Modbus RTU)	mV (can be converted to mA or Modbus RTU)	mV (can be converted to mA or Modbus RTU)	mV (can be converted to mA or Modbus RTU)
Cable Length	10 m	10 m	10 m	10 m
Wavelength Range	285 nm to 3000 nm	285 nm to 3000 nm	285 nm to 3000 nm	285 nm to 3000 nm
Environmental Protection Rating	IP67	IP67	IP67	IP67

150/S-MS56
PYRHELIOMETER

Product Description

The 150/S-MS56 is an ISO9060 First Class Pyrheliometer. It is an all-weather instrument used to measure the Direct Normal Irradiance (DNI) in the range 200 nm to 4000 nm. It is highly sensitive and has an ultra-fast response time (<1 s), meaning it can detect quick radiation changes as a result of cloud-cover or aerosols. It also has excellent thermal stability and can still operate optimally under extreme climatic conditions (-40°C to 80°C). The integrated low-power window heater prevents dew deposition and frost. An optional anti-soiling device is also available, ensuring the quartz window is kept free of sand, dust, rain and snow. The 150/S-MS56 has a full 5° opening angle and a 1° slope angle as defined by ISO pyrheliometer standards. It is suitable for the most demanding applications in photovoltaics and meteorology.

The 150/S-MS56 is customarily used in combination with the a Sun Tracker.

Technical Specifications

Specification	Description
ISO 9060 classification	First Class
Response time	95% < 1 s
Zero offset - Temperature change (5K/hr)	<1 W/m²
Non-stability (change/year)	<0.5%
Non-linearity (100 -1000W/m²)	<0.5%
Spectral selectivity (0.35-1.5μm)	<1%
Temp. dependency (-20°C to 50°C / @ 20°C)	<0.5%
Tilt response (at 1000W/m²)	<0.2%
Sensitivity	Approx. 10 μV/W/m²
Impedance	Approx. 5000 Ohms
Measurement Output	mV (can be converted to mA or Modbus RTU)
Operating temperature range	-40°C to +80°C
Cable length	10 m
Spectral range (>50% transmittance)	200 nm to 4000 nm

150/S-21G,
150/S-22G,
150/S-32G
SUNTRACKERS

150/S-21G

150/S-32G

Product Description

A range of compact single- and double-arm Sun Trackers are available to accommodate a variety of solar sensors. They ensure sensors are accurately positioned, either to expose or shade them from the direct sun beam.

A pyrheliometer (DNI sensor), shading assembly and pyranometer can be combined to measure the direct and diffuse radiation components. To measure diffuse radiation, a shading ball assembly is required with a double-arm sun tracker.

The Sun Trackers are compact, robust, lightweight and energy efficient. They have a built-in GPS receiver for accurate sun tracking. The standard sun sensors compensate for any geometrical misalignment, ensuring absolute precision of measurements.

Technical Specifications

Specification	150/S-21G	150/S-22G	150/S-32G
Type	Single Arm	Dual Arm	Dual Arm, Heavy Duty
Motor	Stepping motor	Stepping motor	Stepping motor
Pointing Accuracy	<0.01° (Solar Elevation 0 to 87°)	<0.01° (Solar Elevation 0 to 87°)	<0.01° (Solar Elevation 0 to 87°)
Angle Resolution	0.009°	0.009°	0.0036°
Rotation Angle	Elevation angle -15° to 95°; Azimuth angle 0° to ±180°	Elevation angle -15° to 95°; Azimuth angle 0° to ±180°	Elevation angle -15° to 95°; Azimuth angle 0° to ±180°
Torque	12 Nm	24 (12+12) Nm	60 (30+30) Nm
Payload	7 kg balanced	20 kg balanced	60 kg balanced
Tracking Accuracy	±0.01°	±0.01°	±0.01°
Sun Sensor Field of View	±15°	±15°	±15°
GPS Sensor Accuracy	Below 15 m	Below 15 m	Below 15 m
GPS Sensor Start Time	<5 min (depending on receiving conditions)	<5 min (depending on receiving conditions)	<5 min (depending on receiving conditions)
Environmental Protection	IP65	IP65	IP65
Temperature Range	-40°C to 50°C	-40°C to 50°C	-40°C to 50°C
Altitude Limit	No Limit	No Limit	No Limit
Communication	RS-232C, 9600 bps, 8N1	RS-232C, 9600 bps, 8N1	RS-232C, 9600 bps, 8N1
Power	AC100 to 240 V, 50/60Hz, 50 W (DC power available)	AC100 to 240 V, 50/60Hz, 50 W (DC power available)	AC100 to 240 V, 50/60Hz, 50 W (DC power available)
Dimension	430 mm (W) x 380 mm (D) x 440 mm (H)	430 mm (W) x 380 mm (D) x 440 mm (H)	430 mm (W) x 380 mm (D) x 250 mm (H)
Weight	14.5 kg	15.5 kg	15 kg

150/S-MS700, 150/S-MS710, 150/S-MS712
SPECTRORADIOMETERS

150/S-MS700 150/S-MS710 150/S-MS712

Product Description

Spectroradiometers are used as reference instruments for outdoor spectral irradiance measurements. They are useful for determining the individual properties of a light source at each wavelength. Characterizing the light in this way helps us to understand its behaviour and energy distribution. Knowledge of these is essential for research and development in photovoltaics and many fields of meteorology.

These spectroradiometers cover a spectral range of 300 nm to 1700 nm. They are designed for permanent outdoor installations, but are equally suitable as a travelling reference.

With no moving parts, the rugged optical design of the diffusor and input optics make these superior to other fibre optic spectroradiometers, which are susceptible to mechanical vibration. They benefit from an advanced temperature-controlled spectrometer. This ensures optimal performance and long-term stability in fluctuating temperature environments.

They come with a separate power supply and can be controlled using specially designed software with advanced functionalities for data retrieval and storage. Photosynthetic Active Radiation (PAR), Photosynthetic Photon Flux Density (PPFD) and illuminance (lux) can be easily calculated.

Technical Specifications

Specification	150/S-MS700	150/S-MS710	150/S-MS712
Wavelength Range	350 nm to 1050 nm	300 nm to 1100 nm	900 nm to 1700 nm
Wavelength Interval	1.2 nm to 2.2 nm	1.2 nm to 2.2 nm	1.2 nm to 2.2 nm
Spectral Resolution	<7 nm	<7 nm	<7 nm
Wavelength Accuracy	<0.3 nm	±0.2 nm	±0.2 nm
Exposure Time	10 ms - 5 s	10 ms - 5 s	10 ms - 5 s
Temperature Control	25±5°C	25±2°C	-5±0.5°C
Window Material	Optical Glass	Quartz Glass	BK7
Communication	RS-422	RS-422	RS-422
Cable Length	10 m (optional max. 30 m)	10 m (optional max. 30 m)	10 m (optional max. 30 m)
Power	12 VDC, 50 VA	12 VDC, 50 VA	12 VDC/5 VDC
Operating Temp. Range	-10°C to +40°C	-10°C to +50°C	-10°C to +40°C
Dimensions (sensor)	200 (D) mm x 175 (H) mm	220 (D) mm x 197 (H) mm	300 (D) mm x 200 (H) mm
Weight (sensor)	4 kg	4.5 kg	7.5 kg

150/S-CBME80B
CLOUD CEILOMETER

Product Description

Frequently used by airports and by others in the meteorological sphere, ceilometers measure cloud height and atmospheric aerosol concentration.

This compact and lightweight ceilometer works by means of a laser-based Light Detection & Ranging (LIDAR) technique to determine cloud base heights, penetration depths, mixing layer height and vertical visibilities.

Up to three cloud layers can be detected simultaneously. The instrument has a measuring range of up to 7,500 m. The light-emitting component is a long-life, low-power diode laser, which is limited to eye-safe levels.

This reliable ceilometer is very easy to install and maintain and can be used for both fixed and mobile installations.

Technical Specifications

Specification	Description
Range	0-7,500 m / 0-25,000 ft
Reporting Resolution	10 m / 30 ft, units selectable
Accuracy	±10 m or ±1% of height measured against hard target (whichever is largest)
Reporting Interval	Periodic (15-120 s), selectable polling (any interval)
Laser Safety	Eye safe Class 1M in accordance to IEC 60825-1
Operating Temperature	-40°C to +55°C
Weight	15 kg
Power Supply	115 VAC 230 VAC, 45-65 Hz or 12 VDC (please specify requirements when ordering)
Power Consumption	Electronics 30 W, Heater 200 W (when active)
Interface	RS-232, RS-485, FSK/V23
Data	Cloud height (up to 3 layers) or vertical visibility
	Cloud Amount / Sky Condition
	Status Information
	Backscatter Profile

150/S-BTD-300
LIGHTNING DETECTOR

Product Description

This Lightning Detector reliably identifies both cloud-to-cloud and cloud-to-ground lightning strikes within an 83 km range. Operating on a quasi-electrostatic principle, the instrument has a very low false alarm rate, and the capability to warn of the risk of overhead lighting before the first discharge occurs. The optional warning relay module allows the sensor to automatically sound an alarm whenever a storm approaches.

This instrument, which meets Federal Aviation Authority (FAA) requirements, can be easily installed, and is virtually maintenance free. It has high immunity to radio interference.

Technical Specifications

Specification	Description
Detects	Cloud-to-cloud, cloud-to-ground and intra-cloud lightning discharges
Output	Ethernet or Serial data (RS422)
Range	83 km (51 statute miles)
Detection efficiency	95% for single lightning flash (any type)
	99% for storm with 2 flashes
	99.9% for storm with 3 flashes
	For flashes within 56 km
False alarm rate	<2%
Range Measurement	0 to 20 km ± 5 km
Error	20 to 83 km ± 10 km
Maximum flash rate	120 per minute
Time of flash	Nearest 10 ms (internal clock)
Measurement principle	Passive, quasi-electrostatic. No moving parts
Direction (optional)	Reported to nearest degree
Sensor Power	110 to 240 VAC 50-60Hz Universal
Operating Temperature	-40°C to 60°C
Operating Humidity	5-100% RH
Protection rating	IP66
Weight (Sensor Head)	25 kg

WATER
QUALITY

The quality of water is determined by its chemical, physical, biological and radiological characteristics. Adequately monitored, these can be used to provide an overall indication of water quality. This is useful in order to promote healthy ecosystems and human safety.

Munro Instruments provides sensors to enable accurate measurement of a number of key water quality indicators including Optical Dissolved Oxygen (DO), Electrical Conductivity (EC), Water Acidity (pH), Oxidation Reduction Potential (ORP), Total Dissolved Solids (TDS), Resistivity, Salinity, Temperature and Depth.

150/WQ10 **WATER QUALITY PROBE**

Product Description

This versatile probe facilitates the measurement of a wide range of water quality parameters.

These include:

Optical Dissolved Oxygen (DO): One of the primary indicators of aqua quality, this measures the concentration of dissolved oxygen in water.

Absolute Electrical Conductivity (EC): Provides an indication of the presence of inorganic dissolved solids and therefore reduce the purity of water. Pure water is an extremely poor conductor of electrical currents and therefore a change in EC can suggest degradation of water quality.

Specific Electrical Conductivity (EC): The EC adjusted to reflect the temperature of the water being tested.

Water Acidity (pH): Aquatic organisms are often sensitive to the acidity of water. Therefore, monitoring and maintaining the pH balance is important in many situations.

Oxidation Reduction Potential (ORP): Oxidation is the loss of electrons by a chemical species following the introduction of a new species. The corresponding reaction is the reduction process in which chemical species gain electrons. ORP is therefore an indication of the potential for oxidation or reduction reactions to take place.

Total Dissolved Solids (TDS): Indicates the concentration of minerals, salts, metals and ions dissolved in water.

Resistivity: The ability of water to resist an electrical current. This is the opposite of EC. Therefore, a body of water with a high EC will have a correspondingly low resistivity.

Salinity: Provides a value for the concentration of dissolved salts in the water.

Seawater Specific Gravity (SSG): A measure of the density of water. Saltwater is more dense than pure or freshwater.

Temperature: Affects a number of chemical processes that take place in water.

Depth: Indicates the depth using EC.

Technical Specifications

Specification	Description
Probe Communication Protocol	SDI-12
Dissolved Oxygen (DO)	
Range	0-500.0%/0-50.00mg/L
Resolution	0.1%/0.01mg/L
Accuracy	0-200%: ±1% of reading, 200-500%: ±10% of reading
Conductivity (EC)	
Range	0-200 mS/cm (0-200,000 µScm)
Resolution	0-9999µS/cm,10.00-99.99mS/cm,100.0-200.0m
Accuracy	±1% of reading or ±1µS/cm if greater
Total Dissolved Solids (TDS)	
Range	0-100,000 mg/L
Resolution	2 Ranges: 0-9999 mg/L or 10.00-100.00 g/L
Accuracy	±1% of reading or ±1mg/L if greater
Resistivity	
Range	5 Ωcm-1 MΩcm
Resolution	2 Ranges: 5-9999Ωcm or 10.0-1000.0KΩm
Accuracy	±1% of reading or ±1Ωcm if greater
Salinity	
Range	0-70PSU or 0-70.00ppt
Resolution	0.01PSU or 0.01ppt
Accuracy	±1% of reading or ±0.1 unit if greater
Seawater Specific Gravity (SSG)	
Range	0-50 st
Resolution	0.1 st
Accuracy	±1.0 st
Water Acidity (pH)	
Range	0-14pH/±625mV
Resolution	0.01pH/±0.1mV
Accuracy	±0.01pH/±5mV
Oxidation Reduction Potential (ORP)	
Range	±2000 mV
Resolution	0.1 mV
Accuracy	±5 mV
Temperature	
Range	-5°C to +50°C
Resolution	0.01°C
Accuracy	+0.5°C
Depth	
Range	0-100 m (0-330F)
Resolution	0.01 m/F
Accuracy	±1%

SOIL
QUALITY

Soil quality can broadly be defined as a measure of the soil's ability to support plant and animal life, maintain or enhance water and air quality, and support human health and habitation. The indicators required to assess soil quality depend on the way in which the soil is to be used (e.g. for agriculture, construction etc).

Munro Instruments provides sensors to measure the following soil quality parameters:

Electrical Conductivity (EC): Measures the ability of soil water to carry electrical current. This allows users to assess the EC response to salts and fertilisers in the soil.

Volumetric Water Content (VWC): Indicates the quantity of water held by the soil. This is achieved through measurement of the dielectric constant of the soil.

Soil Temperature: The temperature of the soil plays an important role in agricultural productivity.

Soil Water Potential: Indicates the tendency of water that is held by the soil to move.

150/E10, 150/E20, 150/E30, 150/E40
SOIL QUALITY SENSORS

150/E10	150/E20	150/E30	150/E40
SOIL MOISTURE & TEMPERATURE SENSOR	SOIL MOISTURE, TEMPERATURE & ELECTRICAL CONDUCTIVITY SENSOR	SOIL WATER POTENTIAL SENSOR	SOIL MOISTURE, TEMPERATURE & ELECTRICAL CONDUCTIVITY - HARSH ENVIRONMENTS

Product Description

We supply a range of multipurpose soil quality sensors to enable accurate measurement of a number of key parameters. The table below provides further information on each individual sensor and its technical characteristics.

Technical Specifications

Specification	Description			
	150/E10	150/E20	150/E30	150/E40
Apparent Dielectric Permittivity (εa)				
Accuracy	±1 εa from 1-40, ±15% from 40-80	±1 εa from 1-40, ±15% from 40-80	N/A	±1 εa from 1-40, ±15% from 40-80
Resolution	0.1 εa from 1-20, <0.75 εa from 20-80	0.1 εa from 1-20, <0.75 εa from 20-80	N/A	0.1 εa from 1-20, <0.75 εa from 20-80
Range	1-80 εa	1-80 εa	N/A	1-80 εa
Soil Volumetric Water Content (VWC)				
Accuracy	±3% VWC using Topp equation, ±2% VWC using medium specific calibration	±3% VWC using Topp equation, ±2% VWC using medium specific calibration	N/A	±3% VWC using Topp equation, ±2% VWC using medium specific calibration
Resolution	0.08% VWC from 0 to 50% VWC	0.08% VWC from 0 to 50% VWC	N/A	0.2% VWC from 0 to 40% VWC 0.1% for >40%
Electrical Conductivity (EC)				
Accuracy	N/A	±10% from 0-7dS/m, user calibration required above 7dS/m	N/A	±5% from 0-5 dS/m, ±10% from 5-23 dS/m
Resolution	N/A	0.01dS/m from 0 to 7dS/m, 0.05dS/m from 7 to 23.1dS/m	N/A	0.001dS/m from 0 to 23 dS/m
Range	N/A	0-23dS/m (bulk)	N/A	0-23dS/m (bulk)
Soil Water Potential				
Accuracy	N/A	N/A	±25% of reading from -10kPa to -100kPa	N/A
Resolution	N/A	N/A	0.1kPa	N/A
Range	N/A	N/A	-10 to -500 kPa (pF 2.01 to pF 3.71)	N/A
Temperature				
Accuracy	±1°C	±1°C	±1°C	±1°C
Resolution	0.1°C	0.1°C	0.1°C	0.1°C
Range	-40°C to +60°C	-40°C to +60°C	-40°C to +60°C	-40°C to +60°C
General				
Dimensions	10 x 3.2 x 0.7 cm	10 x 3.2 x 0.7 cm	9.6 x 3.5 x 1.5 cm	9.6 x 2.4 x 6.5 cm
Cable Length	Supplied with 5 m cable. Custom lengths available up to a maximum of 75 m	Supplied with 5 m cable. Custom lengths available up to a maximum of 75 m	Supplied with 5 m cable. Custom lengths available up to a maximum of 75 m	Supplied with 5 m cable. Custom lengths available up to a maximum of 75 m
Measurement Time	150 ms	150 ms	150 ms	150 ms
Output	SDI-12	SDI-12	SDI-12	SDI-12

AIR
QUALITY

Air quality refers to the condition and characteristics of the air surrounding us. Air quality has an important impact on many aspects of our life on earth including health, well-being and climate change. There are a number of situations in which the immediate safety of nearby life depends on ensuring atmospheric gas concentrations do not exceed levels that could lead to explosion or poisoning.

Munro Instruments supplies sensors to monitor a number of parameters relating to both indoor and outdoor air quality. These include particulates, volatile organic compounds (VOCs), carbon dioxide, carbon monoxide, nitrogen dioxide, sulphur dioxide, methane and hydrogen sulphide.

150/P600
PARTICLE SENSE

Product Description

The P600 is a real-time air quality monitor used to measure and record the concentration of airborne particles (PM1, PM2.5, PM10 and TSP). In workplace mode, it monitors the inhalable, thoracic and respirable concentrations, giving the user an immediate indication of air quality in health-specific terms. This allows for quick implementation of relief measures.

It is equally suited to indoor and outdoor applications and can be operated via battery or mains supply.

The P600 features internal data logging and can be used in conjunction with the supplied software and smartphone app. This allows users to control and monitor sensors remotely. Multiple sensors can be connected to the same network using fixed wiring (up to 10 km), licence free radio telemetry (up to 20 km) or GSM cellular modems. This makes it ideal for area-specific pollution studies.

Alternatively, the P600 can be integrated with one of our external data loggers and used alongside any other sensor from the 150 series.

The alarm facility informs users when exceedance levels are met.

The software has unlimited data storage and provides a satellite image of the instrument location. A pan/tilt-rotate IP camera can also be fitted.

Technical Specifications

Specification	Description
Operating Time	10 hours from fully recharged internal battery
External Power Source	10 to 12 volts at 150 mA (250 mA with backlight)
Operating Temperature	-5°C to +50°C. Must be sampling prior to excursions below freezing.
Humidity	Up to 100%. Water must be prevented from entering the inlet or exhaust.
Particle Size Range	0.5 to 20 micron diameter
Pump Flow Rate	600 cc per minute
Dimensions	260 x 160 x 190 mm
Digital Output	RS232 9600 baud via PC link
Analogue Output	4-20 mA or 0 to 4 volt analogue of TSP or PM10 channel, 12 bit resolution

150/AQ10 VOLATILE ORGANIC COMPOUNDS (VOCS) GAS ANALYSER

Product Description

Volatile Organic Compounds (VOCs) play an important role in the process that leads to the production of ozone. Ozone can have adverse effects on both the environment and human health. As such, accurate monitoring of VOCs is important. This sensor provides a robust method of monitoring mixed gas VOCs, thus giving an indication of air quality.

Technical Specifications

Specification	Description
Measurement Range	0-100%
Accuracy	±15% FS
Response Time	Max 60 s (at 5% alteration)
Long Term Stability	<15% FS/year at normal load
Running-in Time	1 hour
Supply Voltage	24 VAC/DC
Output	4-20 mA
Dimensions	Protection tube 16 x 190 mm
Weight	250 g
Environmental Protection Rating	IP65
Protection Class	III
Working Range (RH)	0-98% RH in contaminant free, non-condensing air

# 150/AQ20 **CARBON DIOXIDE (CO2) & TEMPERATURE SENSOR**

Product Description

By means of a non-dispersive infrared sensor (NDIR), this sensor measures the concentration of CO_2 in the atmosphere in the range 0-2000 ppm. This sensor can also monitor the air temperature across the range 0°C to +50°C.

Technical Specifications

Specification	Description
Measurement Range	0-2000 ppm
Accuracy	±50 ppm + 2% f.mv
Temperature Dependency	5 ppm/K
Pressure Dependency	1.6 % f. mv/kPa
Response Time	<5 min
Long Term Stability	±1% FS/year
Supply Voltage	24V AC/DC
Output	4-20 mA
Dimensions	64 x 58 x 34.5 mm
Environmental Protection Rating	IP65
Protection Class	III
Operating Humidity Range	0-98% RH in contaminant-free, non-condensing air
Operating Temperature Range	0°C to +50°C
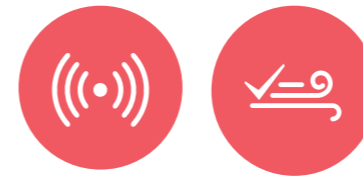
150/AQ80, 150/AQ70, 150/AQ60, 150/AQ40, 150/AQ30 **GAS SENSORS**

Product Description

This range of sensors offer a cost-effective solution to industrial carbon monoxide, nitrogen dioxide, hydrogen sulphide, sulphur dioxide and methane monitoring requirements. Fitted inside an IP65 enclosure, these sensors can be used for both indoor and outdoor applications. These sensors can be mounted in a number of different ways.

Minimal maintenance is required, as these sensors have no moving parts. Drift is minimal. A unique feature is that the electrochemical cell can just be unscrewed and replaced when at the end of its life. This allows for rapid calibration and reconfiguration of the sensor.

Other key features of these sensors are:

- Poison-resistant catalytic bead
- 2-5 year operational lifetime
- IP65 rated enclosure

Technical specification

Parameter	150/AQ80 Sulphur Dioxide Sensor	150/AQ70 Nitrogen Dioxide Sensor	150/AQ60 Methane Sensor	150/AQ40 Carbon Monoxide Sensor	150/AQ30 Hydrogen Sulphide Sensor
Measurement Range	0-50 ppm	0-10 ppm	0-100% LEL	0-500 ppm	0-100 ppm
Supply Voltage	16-30 VDC (0.9W)	16-30 VDC (0.9W)	2.9-3.5 VDC (0.7W)	16-30 VDC (0.9W)	16-30 VDC (0.9W)
Output	4-20 mA	4-20 mA	3 wire mV bridge	4-20 mA	4-20 mA
Protection Type	IP65	IP65	IP65	IP65	IP65
Operating Humidity Range	20-90% RH	20-90% RH	20-90% RH	20-90% RH	20-90% RH
Operating Temperature Range	-15°C to 40°C	-15°C to 40°C	-40°C to 50°C	-20°C to 50°C	-25°C to 50°C

DATA LOGGERS

At the centre of any automatic meteorological or environmental monitoring system is a data logger. We supply a number of data loggers and data acquisition systems to suit the different needs of individual users. However, at their core, they share a number of features:

- Compatibile with a wide range of sensors
- Onboard data processing
- Rugged design to allow operation in extreme conditions
- Suitable for any application in which remote/unattended monitoring is required
- Seamless communication via 3G, UHF Radio Frequency, Zigbee Wireless, Modbus, USB, Ethernet (wired)

Your choice of data logger will likely depend on a number of factors including required communication protocol, sensor outputs and polling frequency. If you would like assistance selecting the data logger best suited to your needs, do not hesitate to ask.

150/DL100
3G/GPRS DATA

Product Description
The 150/DL100 3G/GPRS Data Logger can be used in conjunction with all SDI-12 sensors in the range. It permits an entirely remote approach to environmental monitoring.

The logger exports data at user-defined intervals across the 3G network. It is housed in an IP68-rated enclosure, making it suitable for use in extreme environments.

Technical Specifications

Specification	Description
Data Logger Construction	Over-moulded body with polycarbonate end caps
Data Logger Protection	IP65
Dimensions (approx.)	49 mm (diam.), 200 mm (long)
Environmental Operating Limits	-40°C to +70°C
Enclosure Material	Polycarbonate UV Protection Enclosure or Stainless Steel
Enclosure Dimensions	200 x 150 x 150 mm
Enclosure Protection	IP68
Storage Device	Data-enabled Roaming SIM card (standard size)
Storage Capacity	29768 16-bit readings
Data Export Rate	1 minute to 24 hours
Data Export	.csv file / Graphical
Software	www.climatecloud.club

150/DL1000
DATA LOGGER

Product Description

The 150/DL1000 is a powerful yet cost-effective data logger suitable for a wide range of situations.

The key features of this multi-purpose instrument are:

Real-Time Monitoring – View live data locally or remotely on a clear graphical display in your web browser.

Mathematical & Alarm Functionality – Easily configured through user-friendly software.

Robust – Suitable for use in extreme environments.

Versatile – Connect a wide range of sensors through analogue and digital input channels.

Modbus RTU Channels – Use as either a Modbus Master or Slave.

Ethernet Interface – Send data through the Ethernet port for wired or wireless transmission.

Simple Data Export – Logged data can be exported to CSV for easy analysis.

Please note that this logger is not compatible with the SDI-12 communication protocol. If you require a data logger for use with SDI-12 sensors, please refer to the 150/DL100 Data logger or the 150/DL2000 Real-Time Data logger.

Technical Specifications

Specification	Description
Analogue Channels	8 universal channels: V, mV, mA, Pt100, Pt1000
Sampling	Up to 1000 Hz
A/D Resolution	24 bit A/D conversion resolution
Digital Channels	8 digital I/O's
Serial Channels	RS485, FTP modbus
Calculated Maths Functionality	128 maths channels available.
Alarm Functionality	32 configurable alarms
Relays	3- Normally Open, Normally Closed & common up to 3A @ 150 VAC or 30 VDC
Data Acquisition Rate	Up to 100 different channels can be logged at different rates
Number of Smart Sensors	64 smart sensors can be polled when acting as a modbus master
Internal Storage	512 k
Communication Interfaces	RS485 interface (master and slave), USB interface and host, ethernet interface, wireless (UHF, Zigbee)
Power Supply	100-240 VAC or 24 VDC

150/DL2000
DATA LOGGER

Product Description

Introducing our versatile, low power, high performance Data logger – the Munro 150/DL2000. The 150/DL2000 is perfectly suited to a wide variety of applications in which real-time information, as well as access to historical data, is required.

The key features of this flexible instrument are:

Real-Time Monitoring – View live data locally or remotely on a clear graphical display in your web browser.

Mathematical & Alarm Functionality – Easily configured through user-friendly software.

Robust – Suitable for use in extreme environments.

Versatile – Connect a wide range of sensors through analogue and digital input channels.

Large Memory – Capable of storing up to 10 million data points.

Flexible Wired or Wireless Communications – Via RS232, Ethernet, USB, UHF Radio Frequency or Zigbee Wireless.

Simple Data Export – Logged data can be exported to CSV for easy analysis.

Technical Specifications

Specification	Description
Analogue Channels	5 universal channels: V, mV, mA, Pt100, Pt1000. can be expanded into 15 with 2 wire inputs with a common terminal, or 10 isolated 2 wire inputs.
Maximum Analog Sampling	25 Hz
A/D resolution	18 bit A/D conversion resolution
Digital Channels	8 digital I/O's
Serial Channels	2 smart channels which can accept: modbus serial (RS232, RS422, RS485) master and slave, 4 x SDI-12 inputs
Calculated Maths Functionality	Entensive maths functionality available
Alarm Functionality	Extensive configurable alarm functionality
Relays	1 latching relay: up to 1A @ 30 VDC
Data Acquisition Rate	11 data acquisition rates - from 10ms to days
Number of Smart Sensors	150 smart sensors can be polled
Internal Storage	128MB (10,000,000 data points)
Communication Interfaces	RS232 modbus, TCP/IP ethernet, USB, serial sensor port, SDI-12
Network (TCP/IP) Services	Command interface, web server, modbus server (slave), modbus client (master), FTP server, FTP client
System	Integrated display and keypad. Real-time clock included (±1 min/year @ 0°C to +40°C)
Power Supply	10-30 VDC

150/DAS **DATA ACQUISITION SYSTEM**

Product Description

This is a graphical recording system with Proportional-Integral-Derivative (PID) control. The system includes a Recorder/Controller (3.5" TFT Display), an additional 5.7" Screen and analysis software.

Data from the sensor appears in real-time (in either graphical or numerical form) and is stored in memory for future auditing and researching.

It also has built-in MATHS function, so the user can easily derive further calculations from the readings (e.g. the maximum, minimum and average measurements). In addition, this Data Acquisition system has alarm functionality to alert users when safe levels are exceeded.

Technical Specifications

| Specification	Description	Specification	Description
AMS2750E	Yes	PC Configuration	Yes
Analogue IP/OP	In: 8 Out: 3	Protection	IP65, NEMA12
Annotation	Yes	Recording Speed	8 Hz
Auditor Features	No	Relay Outputs	Yes
Batch	No	Remote Viewing	Yes
Contact Inputs	Yes	Reports	No
Control Algorithms	Single, Cascade, User wired	Review of History (on screen)	Yes
Control loops	2	Timers/Counters/Totals	4 / 15 / 15
Counters	Yes	Totalisers	Yes
Custom Screens	No	Trend Speed	8 Hz
Digital Comms	Modbus TCP/IP Master/Slave EtherNet Slave EtherNet/IP Client/Server	USB	1
Digital IP/OP	In: 4 Out: 5	Input Type	TC, RTD,mV, mA
Ethernet/FTP	Yes	PV Accuracy	<0.1%
Graphic Display	3.5" TFT 320 x 240 pixels	IP Rating	IP65, NEMA12
Groups	1	Display Type	3.5" TFT colour 320 x 240 pixels
Inputs	4	Control Types	On/Off, Proportional Integral Derivative, VP
Mathematics	Yes	Supply Voltage	24 VDC/AC 85-264 VAC
Maths Equation	17 Calculations	SP Programmer	100 Programmes, 25 Segments Local/USB/FP

REMOTE
POWER SUPPLIES

Our systems are built to give users complete flexibility. This includes the ability to install and run your 150 Series systems in remote environments, where there is no access to mains power. This is achieved through the provision of standalone power supplies, which rely on solar or wind energy.
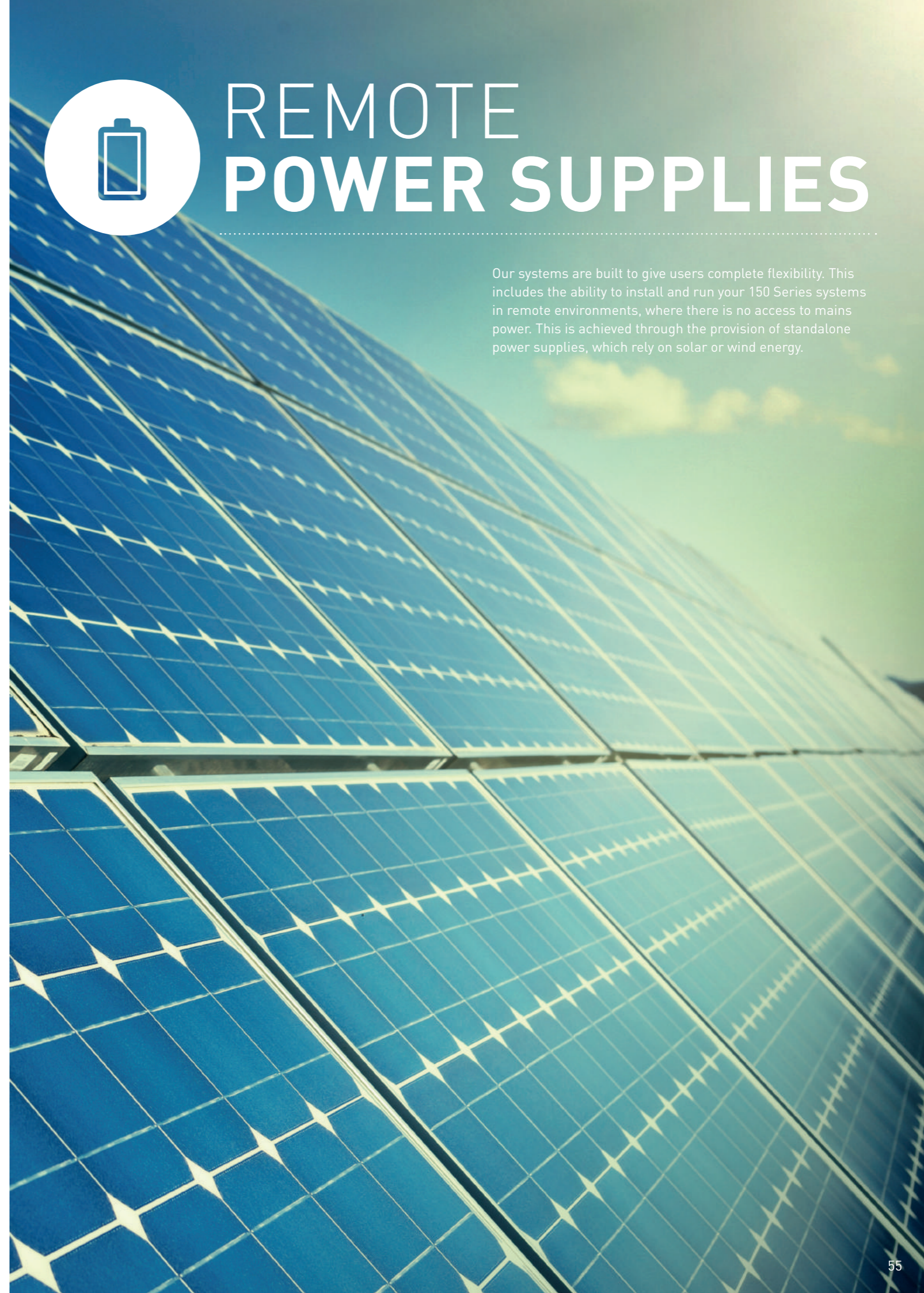
150/RPS **SOLAR PANEL & BATTERY**
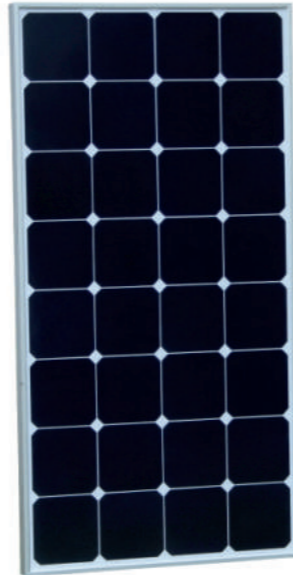
Product Description

This highly efficient solar panel allows you to power your equipment in remote and isolated locations. Capable of performing even in low light conditions, this solar panel is an excellent choice for those wishing to monitor meteorological and environmental conditions in remote areas without ready access to electricity.

The system includes a solar panel (specifically matched to your system), a mounting bracket, a charge controller unit and a deep cycle gel acid battery.

The charge controller has a number of safety features to protect the system. These include:

- Overvoltage protection
- Overheating protection
- Overcurrent protection
- Overload protection @ 1.25 x max load for 60 seconds continuous
- Short circuit protection

Technical Specifications

Specification	Description	Specification	Description
Solar Panel Characteristics		**Charge Controller Characteristics**	
Solar Panel Output	Typically 80W peak (higher peak outputs can be specified depending on system configuration)	Rated Current	10 A
Maximum Power Voltage	17.5 VDC	Terminals	3 pairs of terminals (input, battery, output)
Maximum Power Current	4.44 A	Overload Protection	1.25 x rated current for 60 seconds, 1.5 x rated current for 5 seconds
Open Circuit Voltage	21.6 VDC	Short Circuit Protection	3.5 x rated current
Short Circuit Current	4.8 A	Protection	Overcharge/discharge, overheating
Power Allowance Range	±3%	Self Consumption	6mA
Dimensions	67 x 87 x 3 cm	Working Temperature	-35°C to 55°C
Weight	9.5 kg	Size	14 x 6.5 x 3.5 cm
Mounting	4 mounting holes or can be mounted via a bracket	Weight	140 g
		Type	Gel Lead Acid Deep Cycle Battery
		Rated Voltage	12 V

150/RPT **WIND TURBINE**

Product Description

The Munro Wind Turbine provides a reliable, sustainable source of power. It is compatible with all 150 Series sensors, providing a total solution to the problem of remote weather monitoring. It is professional-grade and can be operated unsupervised in extreme climatic conditions. The body is made of high-grade, corrosion-proof materials, and all mechanical components are integrated into sealed housings, completely shielded from dust, salt and humidity. The rotor blades, made of carbon fibre reinforced plastic, have been optimized for maximum efficiency and minimum noise emission.

The electric power generated by the turbine can be used directly or to charge batteries. A charge regulator automatically diverts the turbine's surplus power to the dump resistors when the batteries have reached maximum capacity. When fully charged, the turbine continues operating and provides useable power as soon as electric consumers are switched on. The state of change is indicated by an LED. The charge regulator is suitable for lead acid batteries, gel batteries and AGM batteries (not provided) and has temperature-compensated charging characteristics. If necessary, the maximum charging voltage can be adjusted to meet customer requirements. The charge regulator is completely sealed and effectively protected against the outdoor environment.

A stop-switch is fitted to shut down the wind generator when not in use. It disconnects the turbine from the battery and stops the rotor from spinning. A mast is also available.

The Munro Wind Turbine is designed for use with the 150 Series sensors. It is, nevertheless, suited to a broad range of applications, including traffic control systems, environmental monitoring stations, mountain shelters, campsites, country houses and sailing boats. It can also be used as a means of rural electrification in remote areas.

Technical Specifications

Specification	Description
Nominal Power	350 W
Nominal Wind Speed	12.5 m/s
Cut-in Wind Speed	3.5 m/s
Cut-off Wind Speed	None
Rotor Diameter	1.20 m
Number of blades	3
Blade Material	CFK
Rotor Speed	500 - 1300 rpm
Generator	Permanent Magnet
Nominal Voltage	12 VDC/24 VDC
Speed Regulation	Rotor blade pitch
Power Regulation	Rotor blade pitch
Brake	Generator short circuit
Weight	11.5 kg
Rotor Thrust (operation)	70 N
Rotor Thrust (extreme wind speed)	220 N

MASTS

Munro Instruments supplies masts and tripods suitable for a range of applications. If you have any specific requirements, we can also offer a bespoke design service.
Please enquire for further details.

150/ML **ALUMINIUM LATTICE MAST**

Product Description
This Aluminium Lattice Mast is extremely strong, yet lightweight and easy to install. The mast comes with a grounding kit and can be guyed to the floor during extreme environmental conditions.

The main body of the mast is made of high-quality aluminium and stainless steel for the bolts and fasteners. Custom fittings for particular sensors are also available. Please enquire for further details.

Technical Specifications

Specification	Description
Face width	375 mm
Section Length	3050 mm (suitable for airfreight)
Section weight	11.8 kg (bare)
Max guyed height	61 m
Height	Heights of 3-61m available. Please specify requirements
Cable Supports	Optional Extra
Ladder	Built-in
Maximum Headload Weight	1000 kg

150/MT **3.5M TRIPOD**

Product Description
This tripod is easy to assemble and can be used for quick deployment of meteorological and environmental sensors. It is made of anodized aluminium and can be fixed to a flat base with screws or pegs.

Technical Specifications

Specification	Description
Maximum Height	3.5 m

MUNRO
INSTRUMENTS