PSM INSTRUMENTATION LTD

Installation & Operation Instruction Manual

APT 1000 Series Transmitters & RFM Series Barriers & Termination Modules

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1.0 Introduction

This manual provides guidance on the installation and operation of the PSM APT 1000 Series of hydrostatic pressure and level transmitters and the RFM family of termination modules and Safety Barriers. The APT 1000 is a programmable instrument which features an RS485 communication port. Where this communication capability is to be used to set the unit up and / or to read the instruments measured data, a separate PSM manual MAN 088 APT 1000 Functionality and Communications is also available which covers this functionality.

2.0 General Information

Safety instructions for APT 1000 & RFM Series Barriers/Termination Enclosures.

To prevent any damage to the device or any injury to the user it is essential that you read the information in this document and observe applicable national standards and safety requirements.

This document is provided to help facilitate the safe and efficient operation of the instrument.

3.0 Product liability and warranty

All apparatus is carefully examined and tested before leaving the PSM workshop and is sent out in perfect order and condition. We, therefore, give the following Guarantee which takes the place of any Guarantee by Statute, common law or otherwise. If within 12 months from date of despatch, any defect or fault is discovered in any component of our manufacture, due to faulty material or bad workmanship, we undertake to make good the defect without charge, provided that notice is given to us immediately on the discovery of the defect and the defective components or parts thereof, are forwarded to us carriage paid for inspection. This guarantee does not apply to defects caused by ordinary wear and tear, misuse, neglect, or by circumstances over which we have no control.

Full terms and conditions are available from our website: www.psmmarine.com/about-us

4.0 Normal operation and maintenance

There is no routine schduled maintenance requirement for the APT 1000 or RFM modules. Periodic checks should be made to ensure all wiring/cable glands are in good condition and terminations secure. Where the APT 1000 is used in tanks liable to sludge or sedimentation, the sensing diaphragm should be examined at appropriate intervals to ensure it is free from contaminants which may obstruct true reading of pressure.
If cleaning is required then EXTREME CARE must be taken to avoid damage to the diaphragm. Use a solvent or water to loosen and flush the deposits and on no account use sharp or hard objects to scrape the diaphragm. If necessary a soft brush may be used with care.
Damage caused to the diaphragm will result in loss of calibration and likely non-linearity / thermal sensitivity to the instrument.

5.0 Instrument return

All equipment is carefully examined and tested before leaving the PSM workshop and is sent out in perfect order and condition.

Should it prove necessary to return any equipment for inspection, please ensure you follow the process:

- Contact PSM for an RVN form and number
- The equipment must be accompanied by an RVN with clear instructions as to the reason for return and what actions are requested.
- An explanation of the apparent fault together with details of the service conditions are also required.
- Health & Safety requirements mean that we must be fully aware of any potential hazards prior to working on returns.

Full terms and conditions are available from: www.psmmarine.com/about-us

6.0 EU conformity

This product meets all of the applicable EU Directives and is supplied with an EU Declaration. Copies of which are available on request.

7.0 Scope of delivery

Inspect the packaging and immediately report any signs of damage to your local agent or PSM Instrumentation.

- APT 1000 Series - Specific model code will depend on your order specification
- Installation Operation & Maintenance Instruction Manual
- EU Declaration

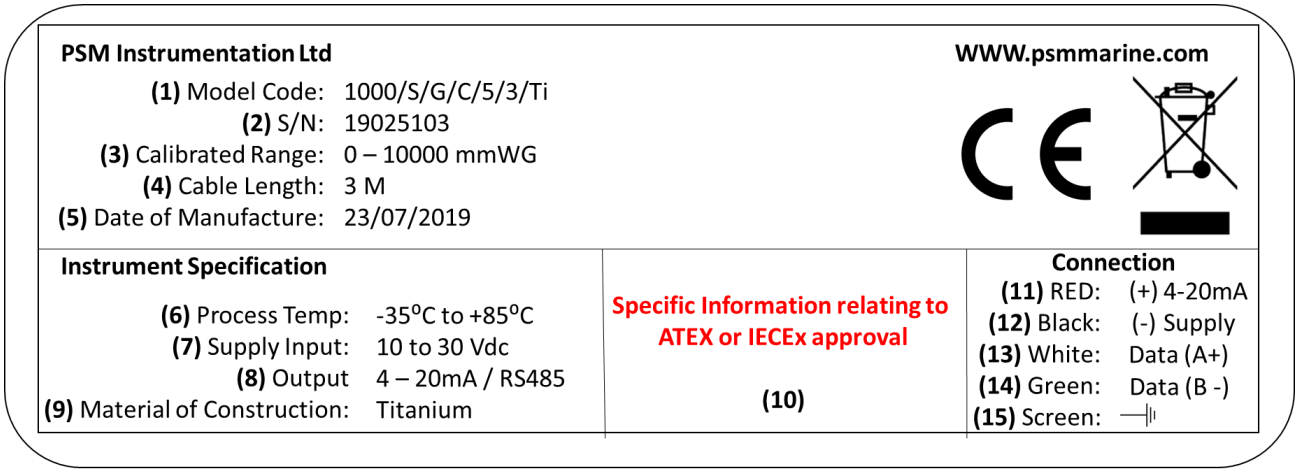
8.0 Storage

- Store the instrument in a dry location
- Storage Temperature range –35°C to +85°C

9.0 Instrument identification

Each instrument is marked with a unique information, that identifies type and construction options.

(1) The model code defines the construction of the sensor.
Refer to section 17.0 and 18.0 of this manual.



(1) Unique Serial number consisting of the PSM sales order . For example 190251 (03), followed by two digits denote the sensors specific identification from the sales order.
(2) This is the actual range the sensor has been calibrated too and in what units of measure.
(3) The specific amount of cable that has been fitted to the sensor.
(4) The date of when the instrument was factory manufactured.
(5) The operating temperature of the instrument.
(6) The range of voltage that can be used for the instrument to operate.**
(7) Analogue Output signal that the instrument outputs (Can be disabled for digital only networks) RS485 Modbus digital communications - always on
(8) The specific materials that have been used in the construction of the instrument
(9) Will identify the certificate number and any other additional conditions when the Instrument is going to be installed into the hazardous area.
(11) Red is positive (+) of the 4—20mA loop.
(12) Black is negative (-) of the 4—20mA loop.
(13) White Data (A+) of the RS485 digital communications
(14) Green Data (B-) of the RS485 digital communications
(15) The screen can be connected to instrument earth

** Where the APT1000 is used as a 2 wire 4-20mA transmitter the maximum load in ohms that can be applied is determined by the available supply voltage based on the following formula

$$\frac{\text{Supply Voltage -10}}{0.02} = \text{Load in Ohms}$$

Where the supply voltage is insufficient the transmitter will not be able to reach its full scale 20mA output.

10.0 Instrument measurement principle

APT 1000 Series level transmitters are designed for monitoring liquid levels and pressures on a wide range of applications. The measurement principle is based on a highly accurate and stable pressure sensitive MEMS piezo-resistive cell

The pressure measurement cell is isolated from the process by a diaphragm and an internal fluid fill transmits the process pressure to it. Precise compensation for the effects of operating temperature change is applied during manufacture by laser trimming of compensation resistors.

The output from the measurement cell is processed by the transmitters internal circuitry to generate a numeric representation of pressure. This value may then be additionally scaled by user configurable settings to provide both a Modbus RTU output and an industry standard 4-20mA signal.

The Modbus communication is bi-directional (half-duplex) it allows the user to set scaling and offset factors such as SG values, sensor fitting height, and tank linearization tables. This means the APT1000 can output meaningful data to a host Master Modbus device.

The transmitters 4-20mA may also be scaled to represent a number of different parameters. Full details of scaling options are provided in PSM manual MAN 088 APT 1000 Functionality and Communications.

The Modbus communication is via an RS485 connection. This permits multiple APT1000 transmitters to be connected on a single multi-drop network. PSM provide purpose designed Termination and Safety Barrier modules - the RFM family - to facilitate simple network construction. These are covered later in this manual.

After assembly, all joints of the transmitter are laser welded and it is fully encapsulated internally.

A choice of construction materials for the wetted parts of the transmitter provide compatibility with most process fluids.

11.0 Instrument configuration

The APT 1000 is fully user configurable in respect of both the Modbus and Current output signals. PSM provide a free Windows PC utility to allow access to all user settings. Full details of the configuration options are provided in PSM manual MAN 088 APT 1000 Functionality and Communications.

12.0 Measurement type

The APT 1000 is offered in two pressure measurement types.

12.1 Absolute sensors

Absolute pressure is measured relative to absolute zero pressure, as would be found in an absolute vacuum. For this measurement the measurement cell is sealed with full vacuum applied internally.

The output from an absolute sensor will change both as a result of any change in process pressure and any change in local barometric pressure. As a result, in order to determine actual process pressure / level from the sensors output a barometric reference value must be applied. This is usually provided by a separate input to the monitoring system from a sensor calibrated to measure barometric pressure.

12.2 Gauge sensors

In this case the measurement cell is vented to ambient air pressure through a vent tube in the sensors cable. This allows the outside ambient air pressure to be applied to the internal side of the cell to balance out ambient barometric pressure. Therefore a vented gauge pressure sensor reads zero pressure when there is no process pressure applied.

Calibration of the sensors is undertaken at PSM Instrumentations facility, all equipment used is externally verified and traceable to UKAS standards.

13.0 Installation APT 1000 Transmitters

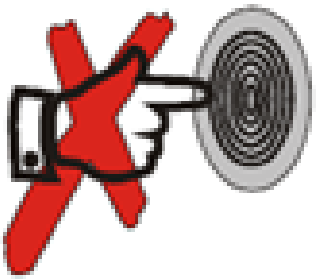
13.1 Mechanical Installation

Prior to installation it is recommended that the following checks are made:

- That any the units configuration is in accordance with the process parameters / tank height and that the nominal range is suitable for the intended duty.
- Verify any instrument identification or tag number to ensure it is fitted in the correct location.

The cable is factory fitted to the APT 1000 ensure a pressure and liquid tight seal. and no attempt should be made to remove the cable gland.

Instrument handling



Before and during installation the following precautions should be taken

- Do not touch the measurement cell of the transmitter
- Do not apply mains voltage to any cable conductor
- Ensure the APT cable sheathing is free from damage and defects

Sensor cable

The cable that is factory fitted to the transmitter is purpose designed for the application. It contains a nylon vent tube which provides an atmospheric reference for the sensor if constructed for a “gauge” measurement application. The end of the nylon tube has a short section of silicon tube fitted, which carries a sintered filter. This filter provides a pressure path, but prevents any moisture entering the vent tube and **MUST** remain in place. The cable may be shortened during installation but if so this filter must be transferred to the new cable end.

Note that the cable has 4 cores. The Red and Black cores are used for both excitation and the 4-20mA signal as what is commonly called a 2 wire transmitter. The White and Green cores are used for the RS485 / Modbus connection to the unit. If the transmitter is to be used only in 4-20mA mode, these can be secured to unused terminals or individually insulated by sleeving.

Note that if the transmitter is constructed as an “absolute” measuring device, then there is no requirement to vent the instrument cable to atmosphere. Precautions must still be taken however to prevent moisture ingress into the cable vent tube.

The cable construction is of sufficient strength to enable the sensor to be directly suspended in deep tanks and reservoirs. The outer sheathing is a special material suitable for continuous immersion in water,and many oils and chemicals. When handling the cable take particular care not to damage the outer sheathing, and when securing using cable ties ensure that no sharp edges can cut the outer insulation or that the cable might be exposed to chafing by moving parts or vibration.

Ensure the cable is not bent to a radius less than 50mm.

When mounting the sensor allow sufficient free cable at the transmitter end to allow easy removal for testing without straining the connection into the transmitter body.

Sensor fitting height

When a transmitter is used in tank level or volume applications it is essential to ensure that the sensor is fitted at a known position and height above the bottom of the tank.
This data must be accurately recorded in the form of X,Y,Z coordinates referenced to known datums on the vessel e.g. baseline, keel or frame numbers.

All calibration data, and any trim or heel tank level measurement correction in the monitoring equipment will be related to this fitting position. If the sensor position is not accurately identified and in agreement with the correction factors the displayed values will be incorrect.

Mounting

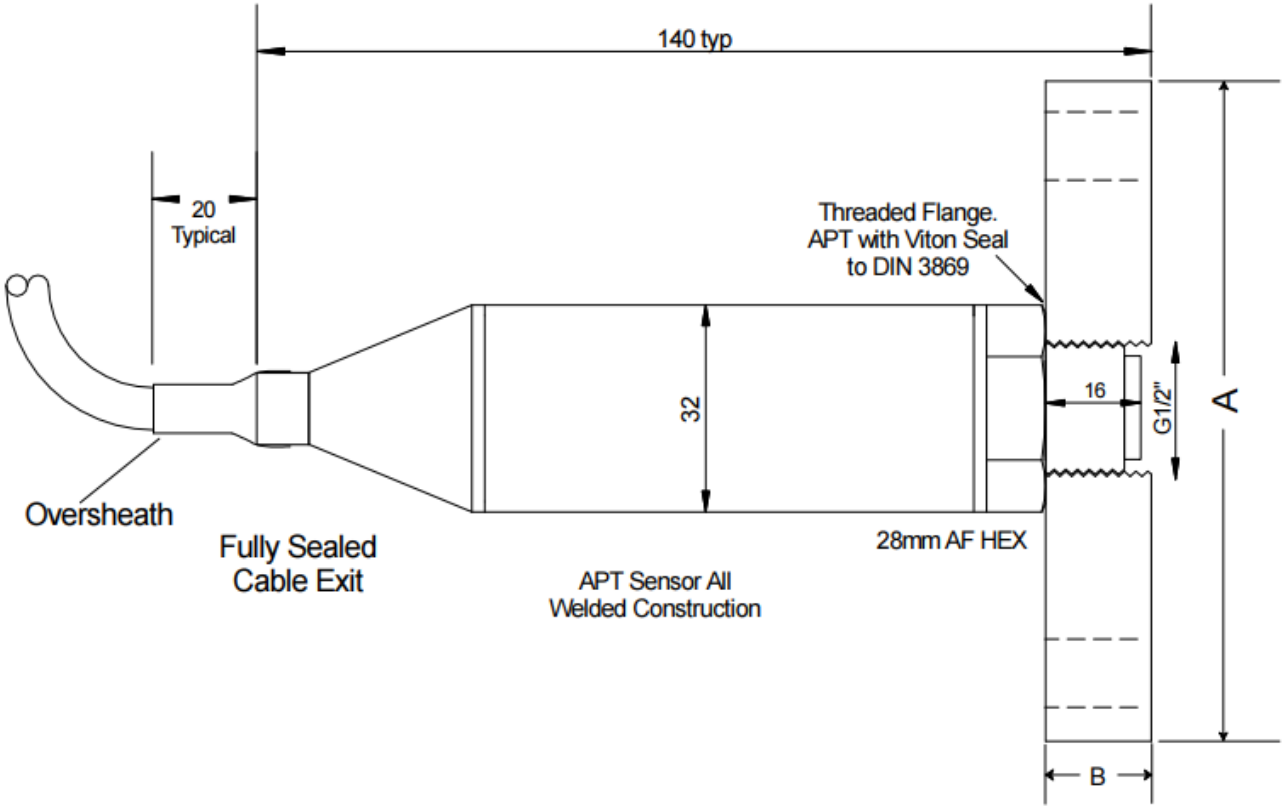
When mounting the unit, and depending upon the type of mounting, ensure that suitable gaskets or sealants are employed to provide pressure tight seals. The sensor should not be mounted where it will be subject to excessive or continuous vibration, extreme temperature fluctuation or risk of mechanical damage, especially to the pressure sensitive diaphragm.

Secure the cable as necessary to prevent mechanical abrasion if it moves.

Do not secure the cable to any localised sources of high temperature heating such as steam coils used in heavy oil tanks.

Mounting Options

The standards APT 1000 has an 1/2” BSPP male process connection with a Viton sealing ring. PSM can provide a number of components and adapters for alternative mounting of the APT 1000. Please contact PSM for further details.



Model	Flange	Holes	PCD	Bolt Size	A	B
----	DN20 PN16	4	75	M12	105	18
----	DN25 PN16	4	85	M12	115	18
----	DN40 PN16	4	110	M16	150	18
----	DN50 PN16	4	125	M16	165	18

Note: Flange Thickness (B) Must be Minimum 18mm to Provide Protection for Sensor Diaphragm

13.2 Electrical installation APT 1000 Transmitters

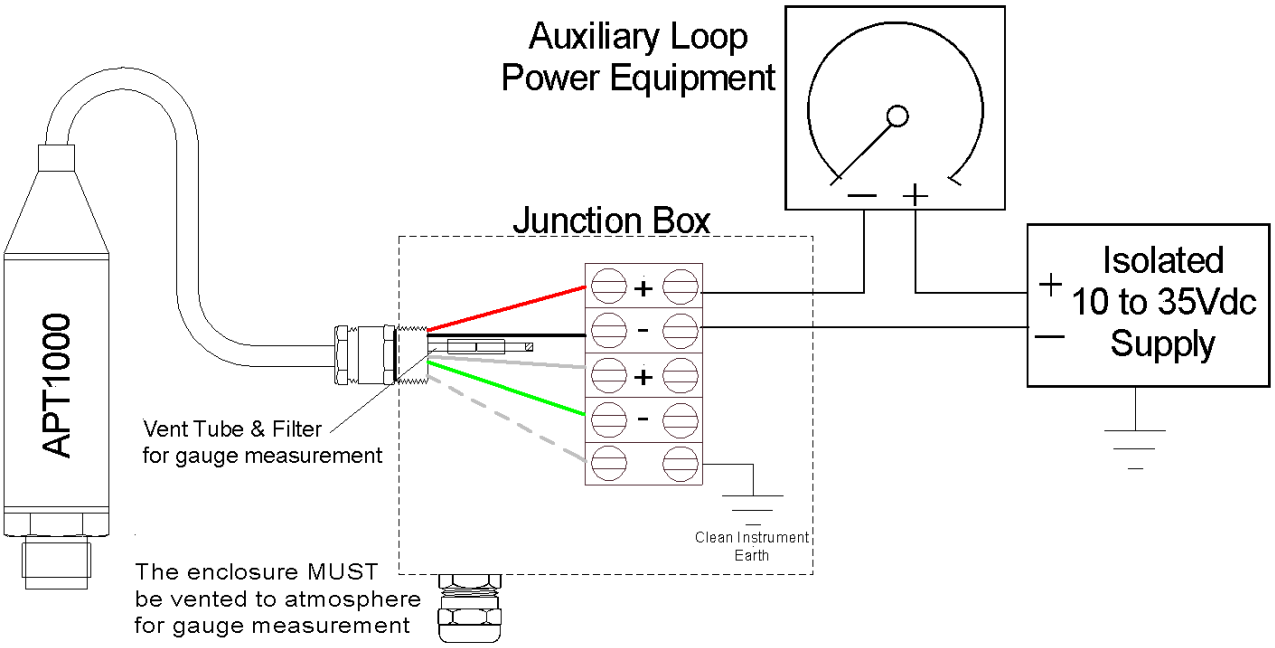
Isolated power supplies

For all installations of the APT 1000 it is important that the instrument is powered from an isolated power supply. The use of a non-isolated power source in a situation where the sensor is grounded by its installation could to lead to issues with any onboard earth fault monitoring system, unwanted earth current loops and the possibility of instability / interference caused by any other equipment on the same power supply

The APT 1000 has dual outputs. Firstly it may be used as a standard analogue 2 wire 4-20mA output transmitter, and secondly as a digital output device communicating via RS485 and using Modbus protocol. Either or both modes can be used simultaneously and the electrical connection required will depend on the intended use.

The sensor cable has 4 cores, Red, Black, Green, & White.

Connect Red conductor to +ve supply.
Connect Black conductor to –ve supply.



Where only the 4-20mA signal is being used then only the Red and Black conductors are used as shown in the diagram below.
The Green and White conductors are used for the RS485 Serial communication. If only the 4-20mA signal is to be used these should be connected to unused terminals or individually sheathed such that they cannot make contact, either to each other or anything else.

Because the RS485 communications can also be used for configuring the 4-20mA signal it is suggested that they are terminated such that temporary connection can be made if needed.

The ability to connect multiple APT 1000 transmitters on a single Multi-drop network provides savings in cabling required and the possibility to communicate with a transmitter from any point on the network.

For simple construction of multi-drop networks PSM also provide three Remote Function Modules (RFM).

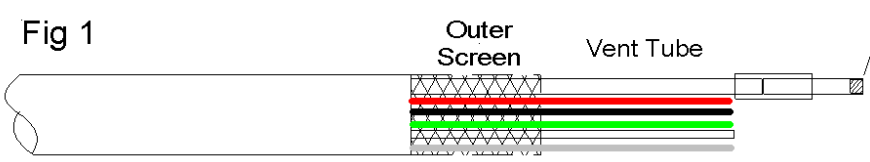
The RFM1 allows for termination of a single APT 1000 and network cables
The RFM4 allows for termination of up to 4 APT 1000 and network cables.
The RFM-ISR is a purpose designed and approved Safety Barrier. The APT 1000 may be supplied with ATEX or IECEx certification suitable for hazardous area installation*. For such installations the RFM-ISR provides energy limiting and protection for both power and communication lines feeding these APT 1000 transmitters.

* Approved Zener Safety Barriers and Galvanic Isolators to provide Intrinsic Safety protection.

Cable Termination

The cable is also provided with an overall braided screen. This braid can be cut back as below

Fig 1



Cable outer sheath and braided screen are cut back (not connected).

Fig 2

Wires to be connected depending on mode to be used.
Analogue mode connect Red / Black
Digital mode also connect White / Green

CABLE CONNECTIONS		
Red	+ Positive	Supply 4-20mA
Black	- Negative	
White	+ Data	RS485 Data
Green	- Data	
Screen/Drain Wire		Earth

Fig 3

NOTE: Vent Tube Breather Plug MUST be refitted for Gauge Pressure Transmitters

All wires and vent to be insulated

Drain wire & cable screen have no internal connection to APT 1000 electronics.
They may be left unterminated, or, where a clean instrument earth is available connected to this

The transmitter's cable is normally provided to the required length but if it is to be shortened on a Gauge pressure type transmitter the nylon vent tube should be cut to a free length of approximately 20mm within the enclosure, it must be ensured that this tube is not blocked or otherwise restricted and the silicon tube containing the sintered filter must be re-fitted to the shortened length.

The termination enclosure **MUST** be vented where the APT 1000 transmitter is of the vented gauge type. PSM's RFM1 & RFM4 termination modules include a suitable vent.

14.0 ATEX and IECEx requirements

For intrinsically safe installations APT 1000 transmitters in the hazardous area must be connected to the safe area via approved safety barriers. These barriers fall broadly into two categories:

- Zener barriers (based on the shunt diode principle)
- Galvanic isolators

Either type of barrier may be employed subject to it meeting the required safety description. PSM can provide guidance on a range of suitable barriers.

Shunt diode Zener barriers provide a resistor to limit the current flow, a (non-replaceable) fuse to limit power and a Zener diode arrangement to limit voltage levels and provide a safe path to earth. Zener barriers tie the 0v side of the transmitter supply to earth either directly or via a
diode arrangement. They must be connected to a high integrity earth to function as intended.

Intrinsically Safe Earth Connections are required to be made but should be made to a separate instrumentation 'Clean Earth'

There are generally two earthing systems recognised. The so-called 'dirty earth' has all the non-critical data equipment and general equipment attached to it. The 'clean earth' has all the critical data systems attached to it on the basis that less 'noise' will be found on this earth

Galvanic Isolators provide full galvanic isolation between safe and hazardous area circuits with power limiting achieved by using a diode resistor network similar to that of a shunt-diode barrier. They do not require a high integrity earth, each side may be earthed independently overcoming potential issues with earth loops.

For all intrinsically safe installations of the APT 1000 it is essential that this instrument is powered from an isolated power supply. When a zener barrier is employed for power limiting this will effectively tie the sensor supply 0V to earth, meaning a non-isolated power source can lead to issues with any onboard earth fault monitoring system, resulting in unwanted earth current loops and instability / interference caused by any other equipment on the same power supply

The use of an isolated supply means that there is no direct connection between the 0 volts / I.S. earth at the sensor and the 0 volts at the ships supply

The PSM RFM-ISR is a purpose developed Zener Safety Barrier. It provides an advantage over general single channel Zener Barriers or Galvanic Isolators in that ia single RFM-ISR can be used to protect multiple APT 1000 transmitters. Protection is provided for both the DC power and Serial communication lines into the Hazardous zone.

Certificates available on request

14.1 Barrier selection

When selecting a Barrier the following parameters must be complied with:

Ui = 28Vdc
Ii = 150mA
Pi = 0.8W
Li = 0
Ci = 0

15.0 Electromagnetic Compatibility

No special conditions are required to maintain EMC protection.

16.0 Mechanical Installation of RFM series

There are two versions of the RFM enclosure, a lightweight Aluminium version intended for installation in locations where it will be protected from corrosive effects of Salt Water etc, and a heavy duty Steel enclosure suitable for installation on open deck conditions onboard a Ship.

In general the location should be selected to protect the enclosure from damage from impact or excessive vibration.

Connection of cabling via the correct cable glands is essential to ensure a weather-tight seal. The enclosure is provided with M20 cable gland threads. Any unused cable entry points must be sealed off with suitable blanking plugs.

Where the RFM modules are to be used with Gauge type APT 1000 transmitters they are fitted with a sintered filter plug in the enclosure to provide a an atmospheric reference for the APT 1000 cable vent tube, This vent must remain in place and not removed or painted over.

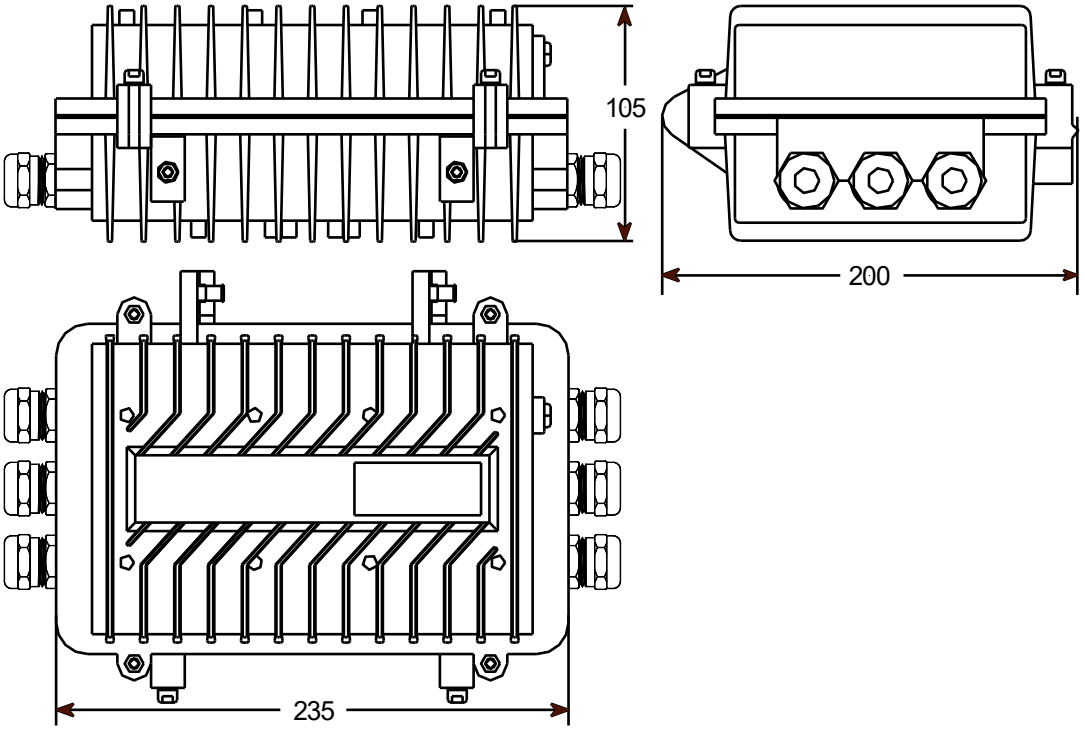
If the RFM module is installed in an area subject to flooding, or local pressurisation / vacuum, then a vent pipe should replace the filter plug. This should be a minimum diameter of 6mm and terminate in a dry, atmospheric pressure location. Where there is no possibility of moisture ingress.

For Sealed Absolute type transmitters no atmospheric pressure reference is needed within the RFM module.

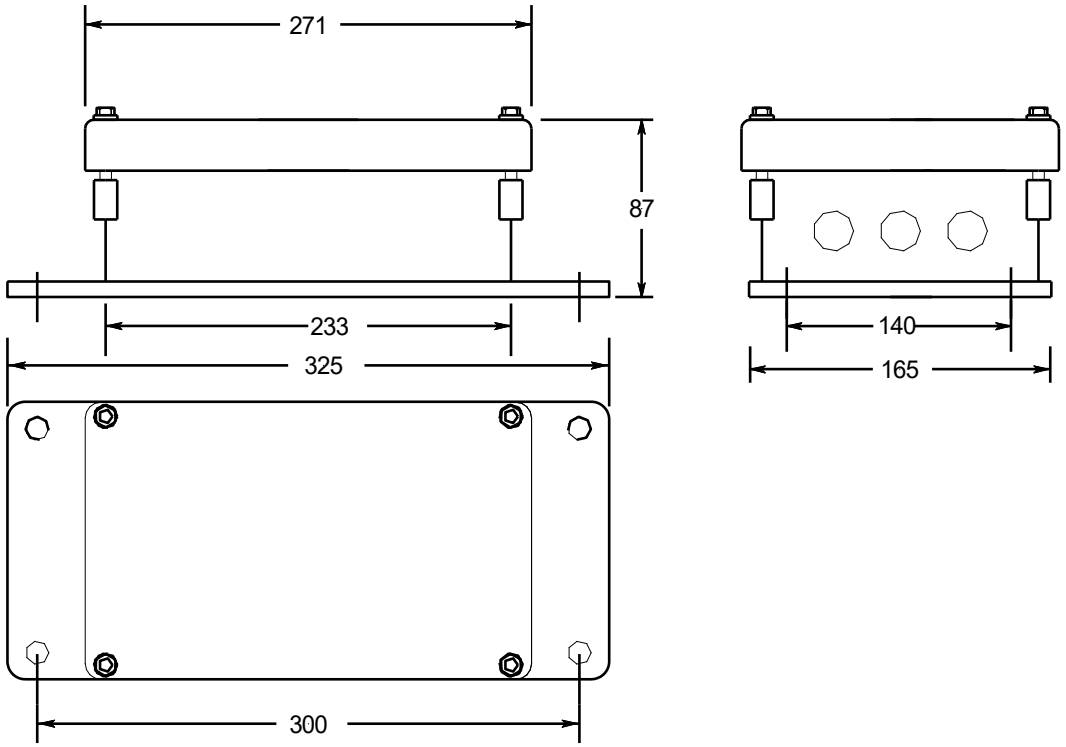
Refer to the following drawings for outline and mounting dimensions for the two RFM enclosure types.

16.1 Dimensional drawings RFM 1 & 4 and RFM ISR

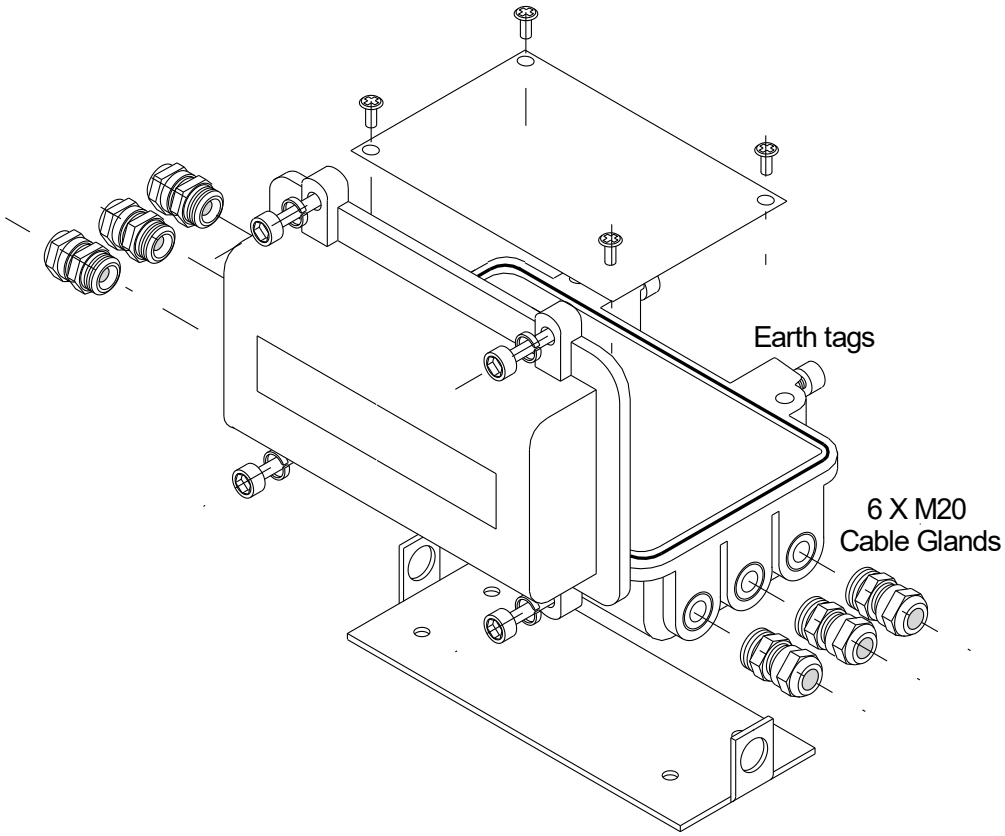
Aluminium case construction



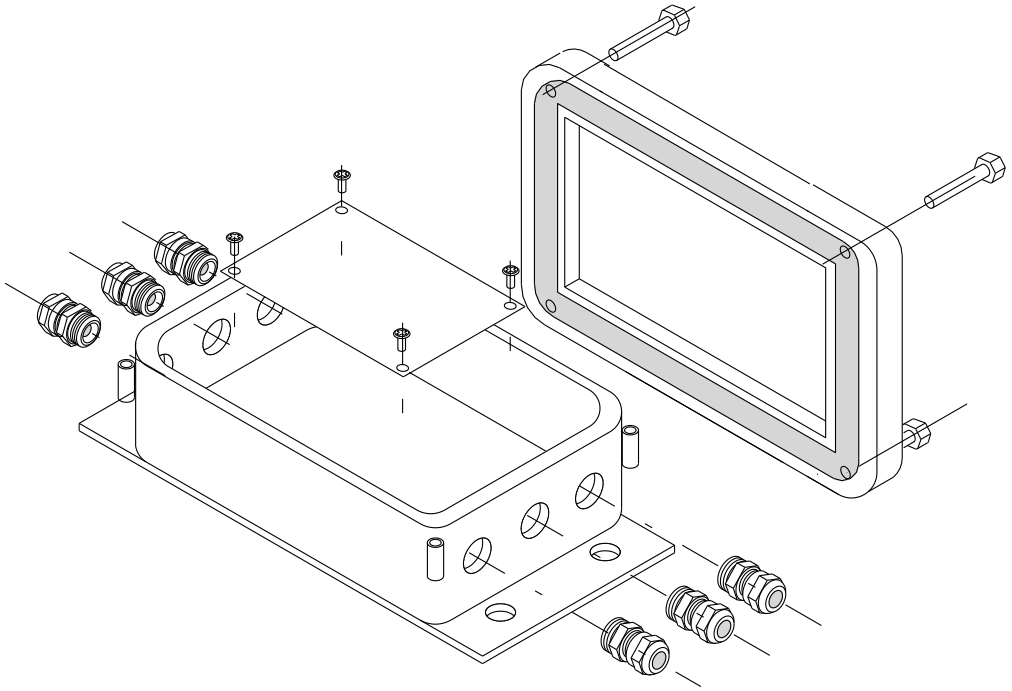
Painted carbon steel case construction



Aluminium RFM enclosure



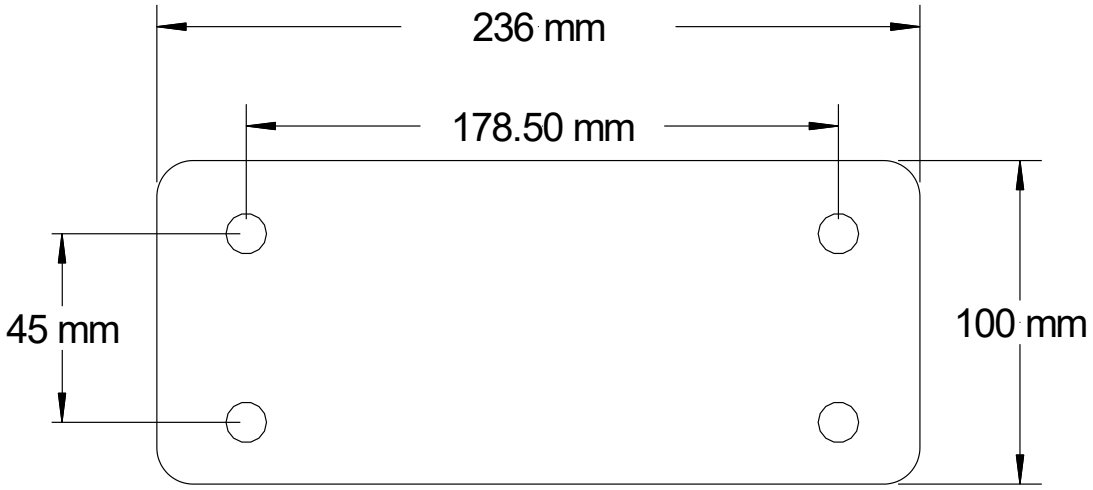
Epoxy Painted Mild Steel RFM enclosure



16.2 RFM Mounting Dimensions

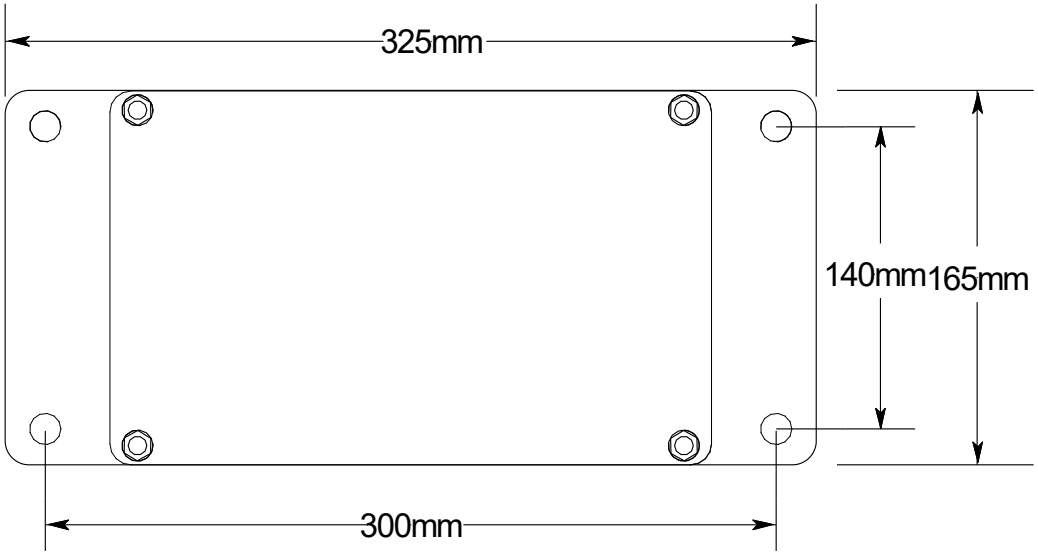
The Aluminum RFM enclosure is provided with a mounting bracket, which is installed prior to the enclosure being fitted.

Bracket dimensions



Once the mounting bracket is fixed in place, the enclosure simply clips in and the centre M20 glands at either end are screwed down, securing the enclosure in place.

Painted mild steel RFM enclosure has four mounting holes located around the base



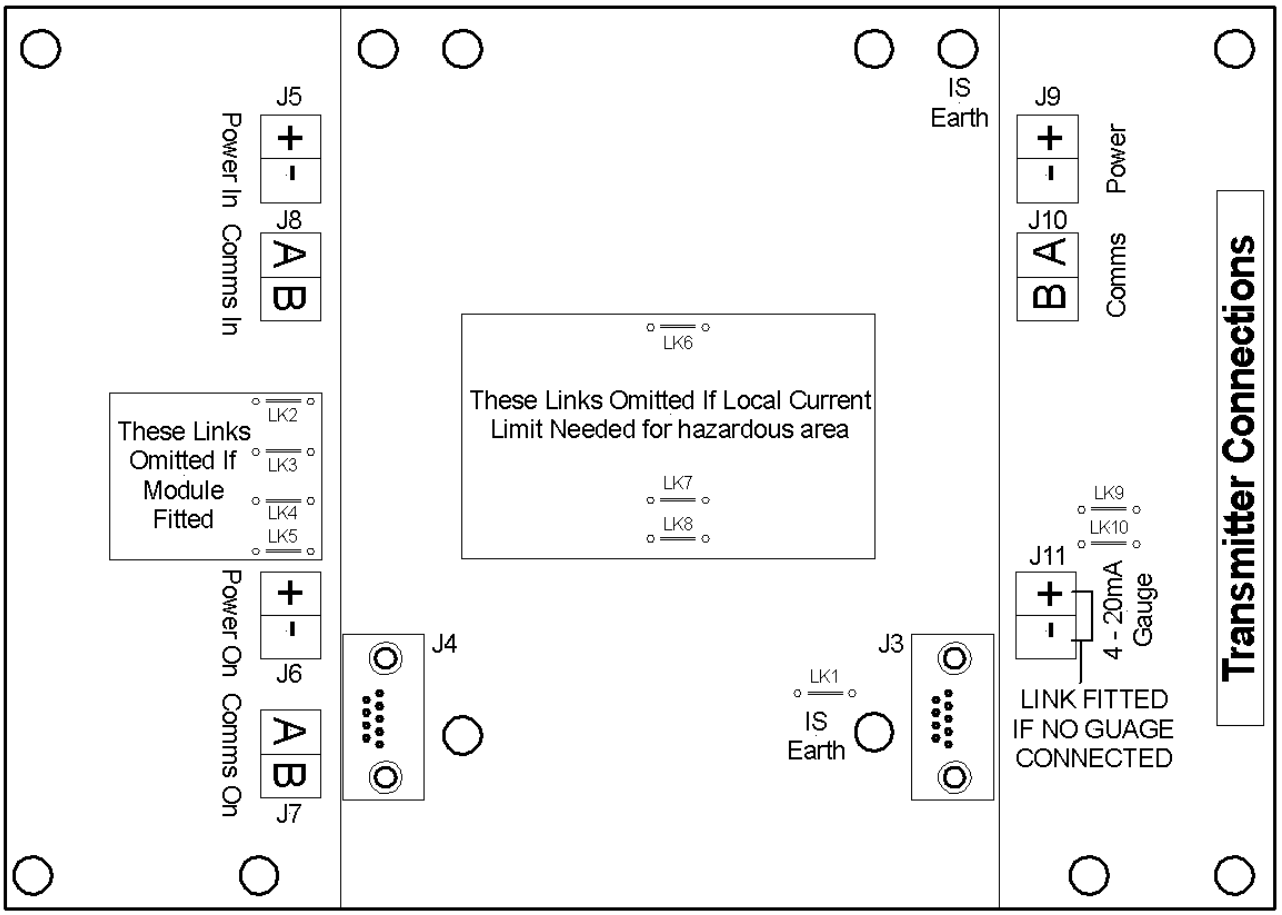
The enclosure can also be welded around the base to the specified location. If this mounting option is chosen a suitable protective coating must be applied to all welded areas.

Location of RFM modules

Both RFM1 and RFM4 modules may be mounted in either a Safe or Hazardous Area. If located in a Hazardous Area both the power and communication cabling MUST be protected in accordance with I.S. requirements meaning a suitable Safety Barrier or Galvanic Isolator must be used. As detailed earlier in this manual. This Safety Barrier / Isolator MUST be fitted in the Safe Area.

NOTE: If an RFM-ISR module is used to provide the required safety it must be ensured that the Hazardous and Safe area cables are routed via the correct cable glands. i.e. Hazardous area on one side and Safe area on the other. Cables **MUST NOT** pass internally across the Barrier's circuit assembly.

16.3 Electrical connection of APT 1000 to RFM 1 (single transmitter)



Refer to the earlier section covering APT 1000 electrical connection for details of the cable termination method.
The RFM 1 module provides connection and Modbus termination for one APT 1000 transmitter

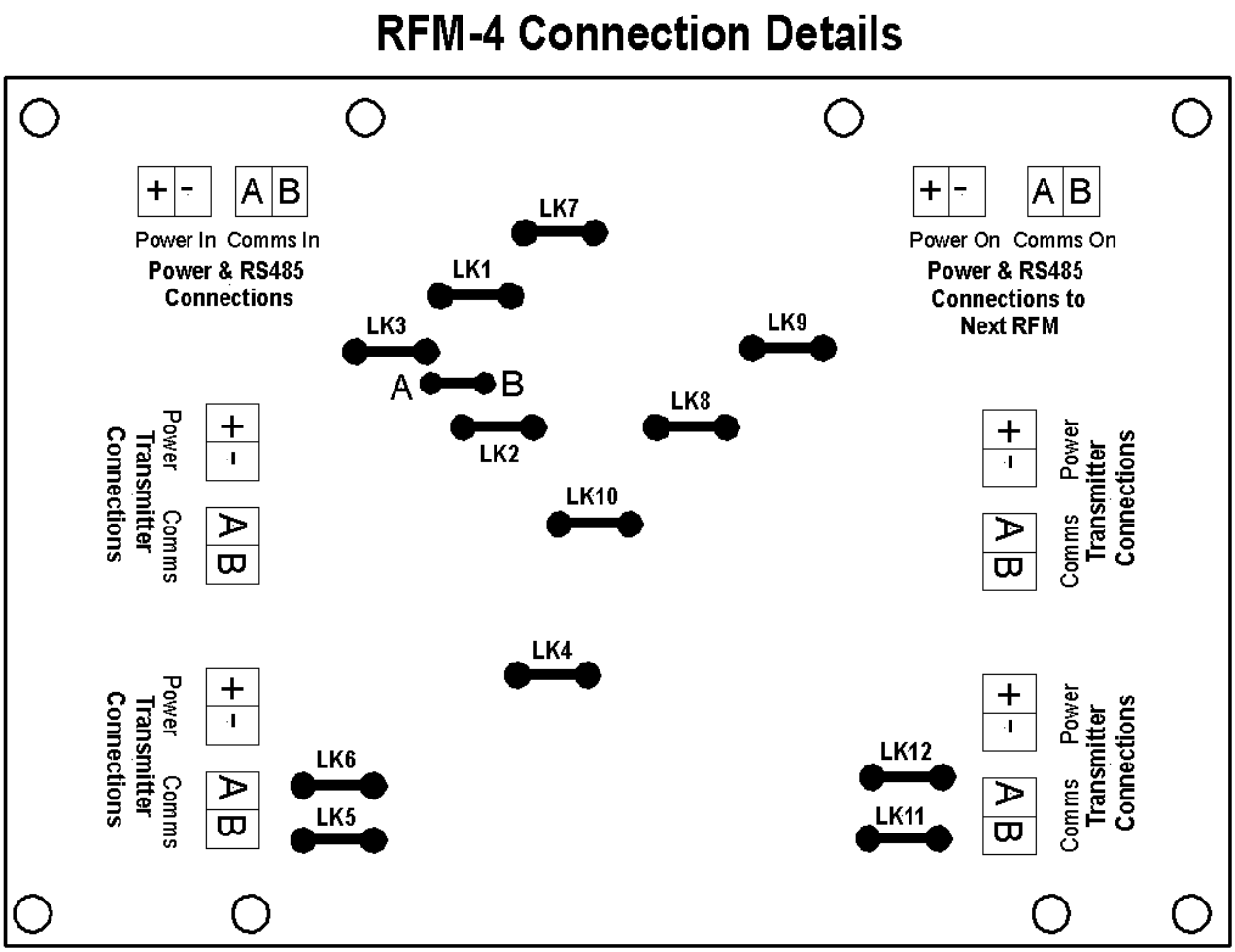
Termination descriptions

J5	8-30Vdc Power supply
J8	RS485/Modbus communications (A + Data / B - Data)
J9	Supply (Red + Black -)
J10	RS485/Modbus (White + Data / Green - Data)
J11	Optional connection to local 4-20mA Gauge. **LINK FITTED IF NOT CONNECTED TO GAUGE**
J6	8-30Vdc Power supply - On to next RFM
J7	RS485/Modbus - On to next RFM
J4 & J3	9 way D-Sub connector to optional Modules

Links LK6, LK7, LK8 **MUST NOT** be fitted when used in an intrinsically safe installation.

Ensure Link LK9 **IS FITTED FOR ALL INSTALLATIONS**

16.4 Electrical connection of APT 1000 to RFM 4 (up to 4 transmitters)



Refer to the earlier section covering APT 1000 electrical connection for details of the cable termination method.

The RFM 4 module provides connection and Modbus termination for up to four APT 1000 transmitters

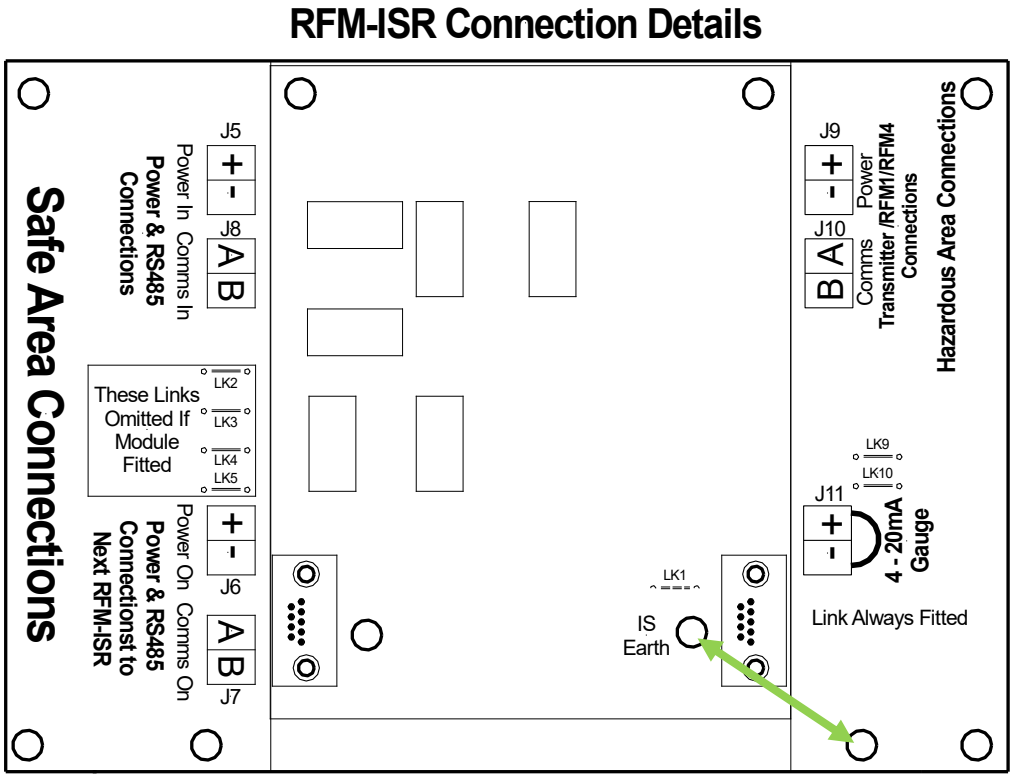
PWRIN	8-30 Vdc Power supply
COMMSIN	RS485/Modbus communications (A + Data B - Data)
Transmitter Connections	Connection to APT 1000 (Red + Black -) (A White + Data B Green - Data)
PWRONW	8-30 Vdc Power supply - On to next RFM
COMMSONW	RS485 Modbus communications - On to next RFM

Links LK6 - LK12 **MUST NOT** be fitted when used in an intrinsically safe installation.

Ensure Link LK9 **IS FITTED FOR ALL INSTALLATIONS**

16.5 Electrical connection of RFM ISR

The RFM ISR module provides safety barriers for power and data connections to RFM 1 & 4 modules when used as part of an APT 1000 network



J5	15-35Vdc Power supply
J8	RS485 Modbus communications (A + Data B - Data)
J9	12Vdc Intrinsically Safe Supply (Red + Black -)
J10	Intrinsically Safe RS485/Modbus (White + Data Green - Data)
J11	Optional connection to local 4-20mA Gauge. Linked out if not used
J6	15-35Vdc Power supply - On to next RFM-ISR (in safe area)
J7	RS485/Modbus - On to next RFM-ISR (in safe area)
J4 & J3	9 way D-Sub connector to Barrier Module

J9/J10 are connected either directly to an APT 1000 or an RFM termination enclosure.

Ensure Links LK2—LK8 are **NOT FITTED** (links 6 to 8 under barrier board)

Ensure Link LK1,9 and 10 **IS FITTED** (Link 1 under barrier board)

REMOVE the **factory fitted earth bonding strap** between the “IS earth” stud and the case **ONLY IF** an external clean instrument earth is available.
The I.S. earth stud on the circuit board should then be connected directly to the external clean instrument earth via either:

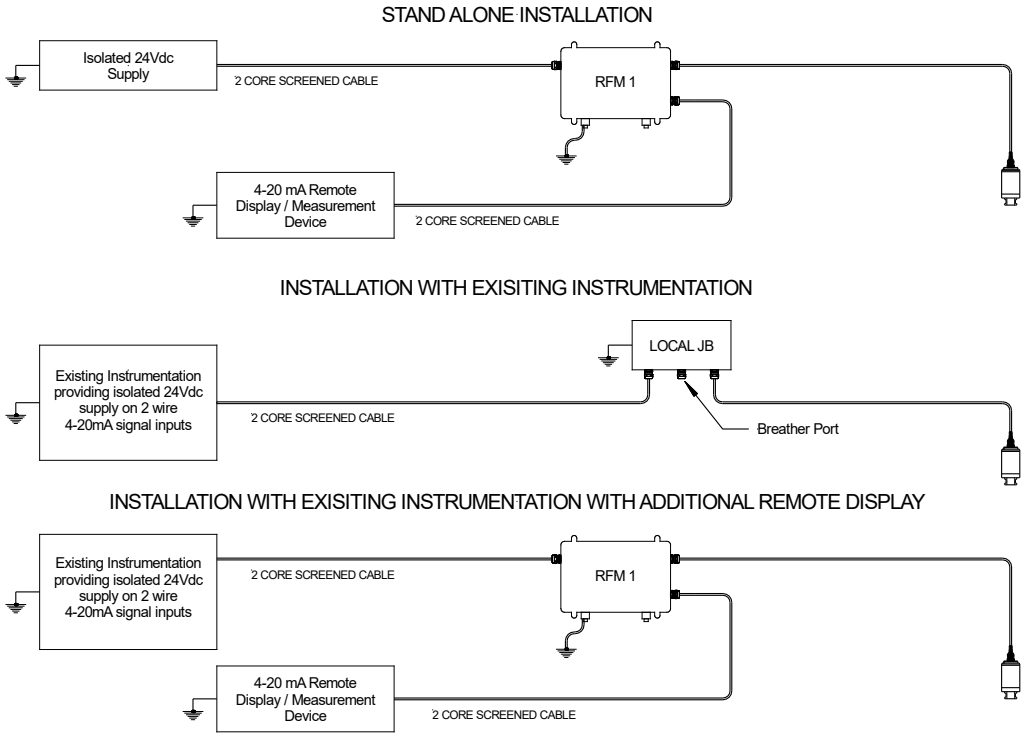
- 2 x Copper conductors each minimum csa 1.5mm2
- 1 x Copper conductor minimum csa 4mm2

17.0 System Interconnections

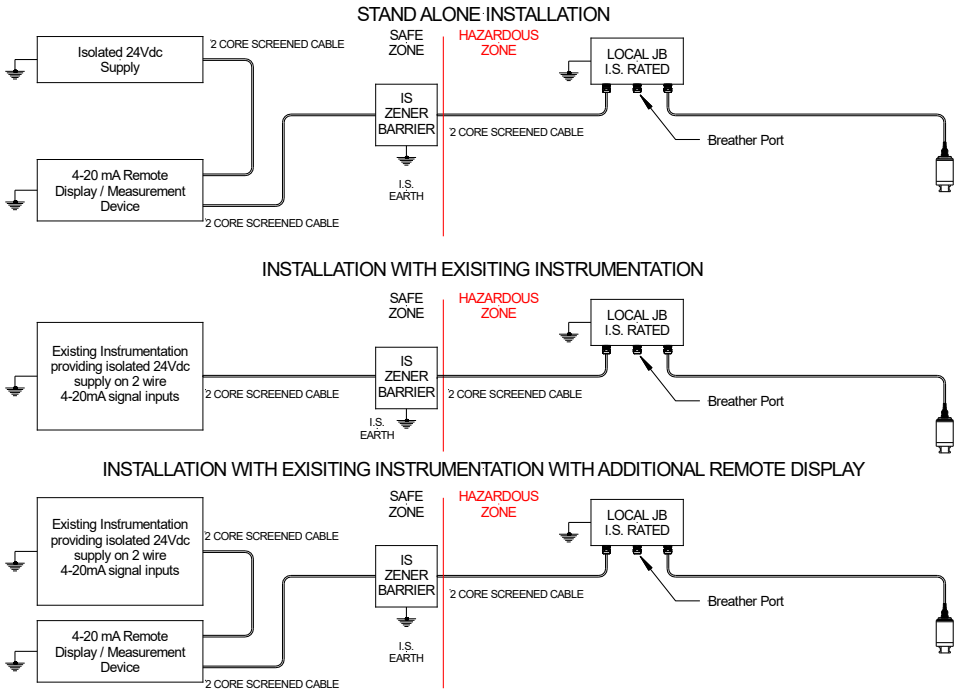
Analog and Digital cable identification

Red	+ Power	Analogue (4-20 mA)	**White**	A (+ Data)	RS485 Digital (Modbus)
Black	- Power		**Green**	B (- Data)	

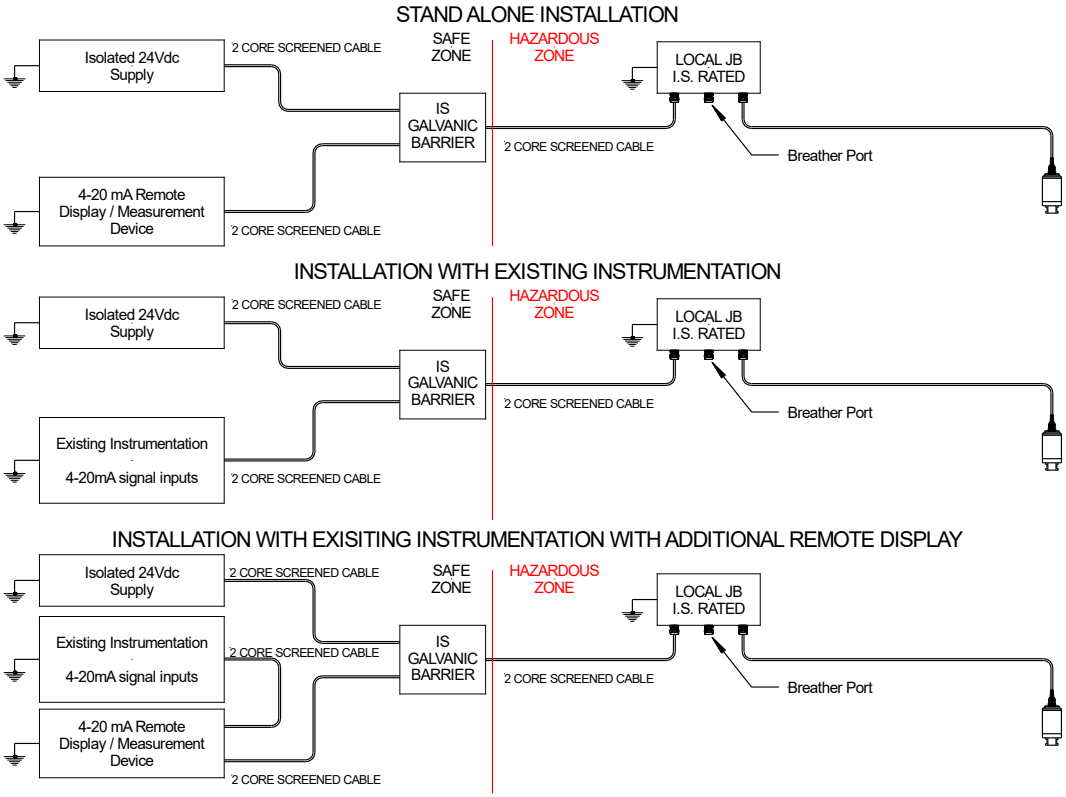
Single APT 1000 Safe Area Connection



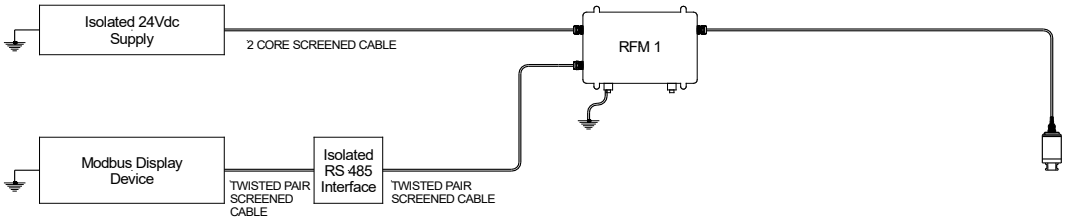
Single APT 1000 Hazardous Area Connection using a Zener Barrier



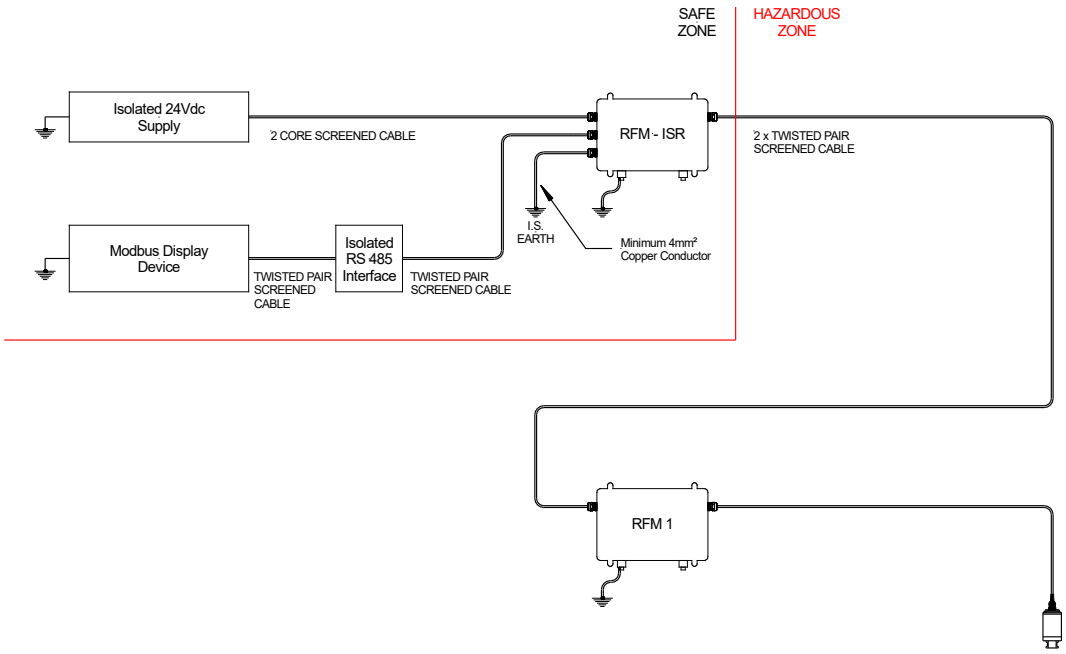
Single APT 1000 4—20 mA hazardous area using a Galvanic Isolator



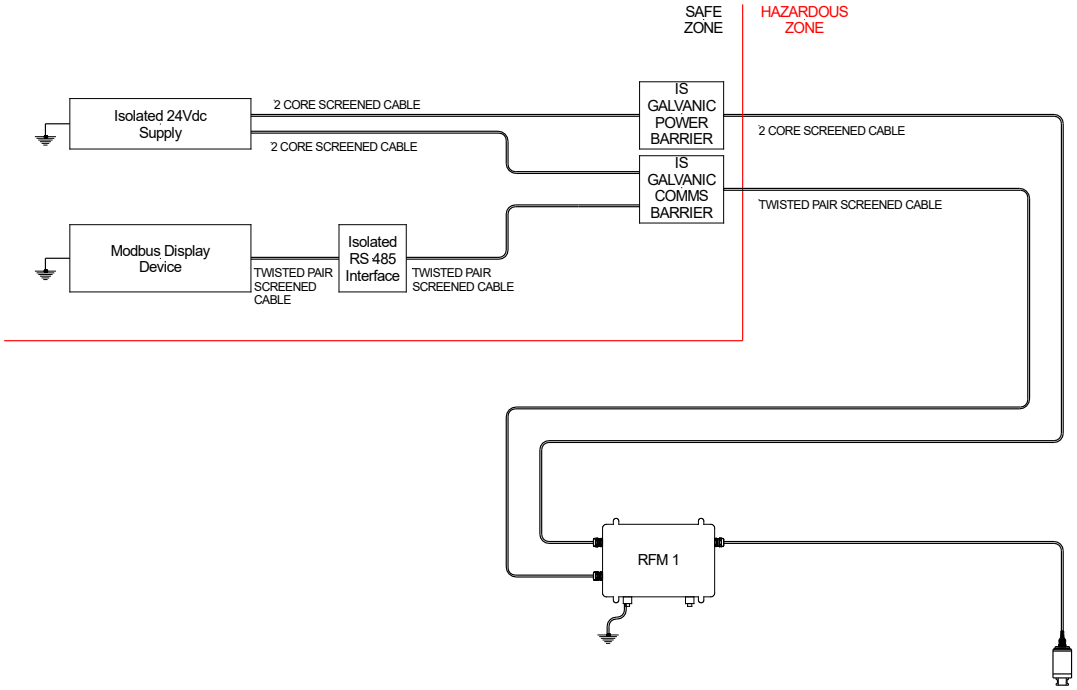
Single APT 1000 digital mode Safe Area Connection



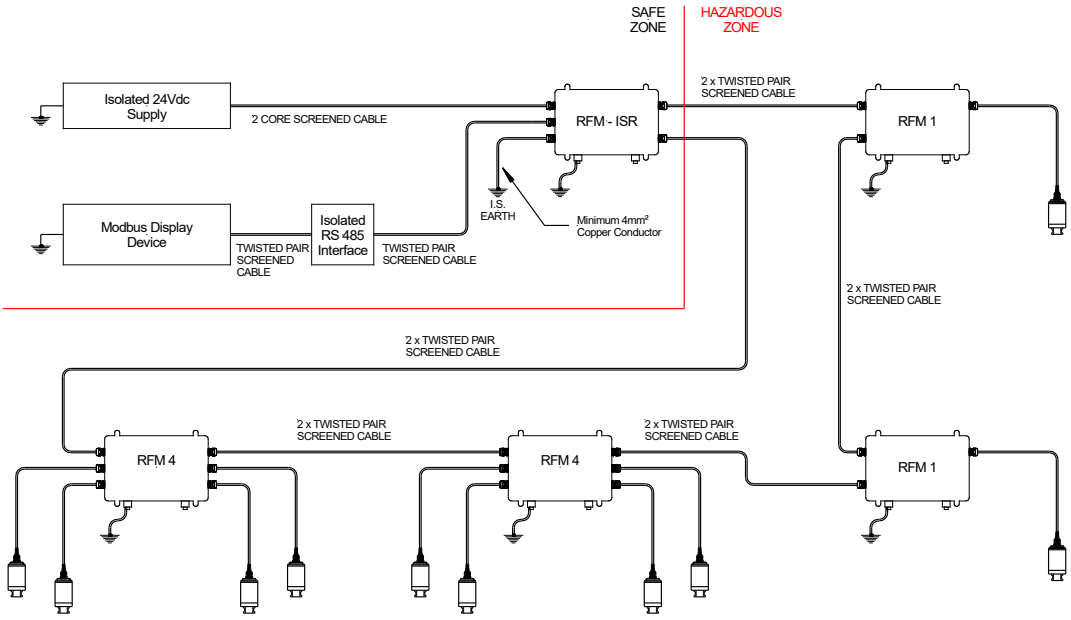
Single APT 1000 digital mode hazardous area using a Zener Barrier connection



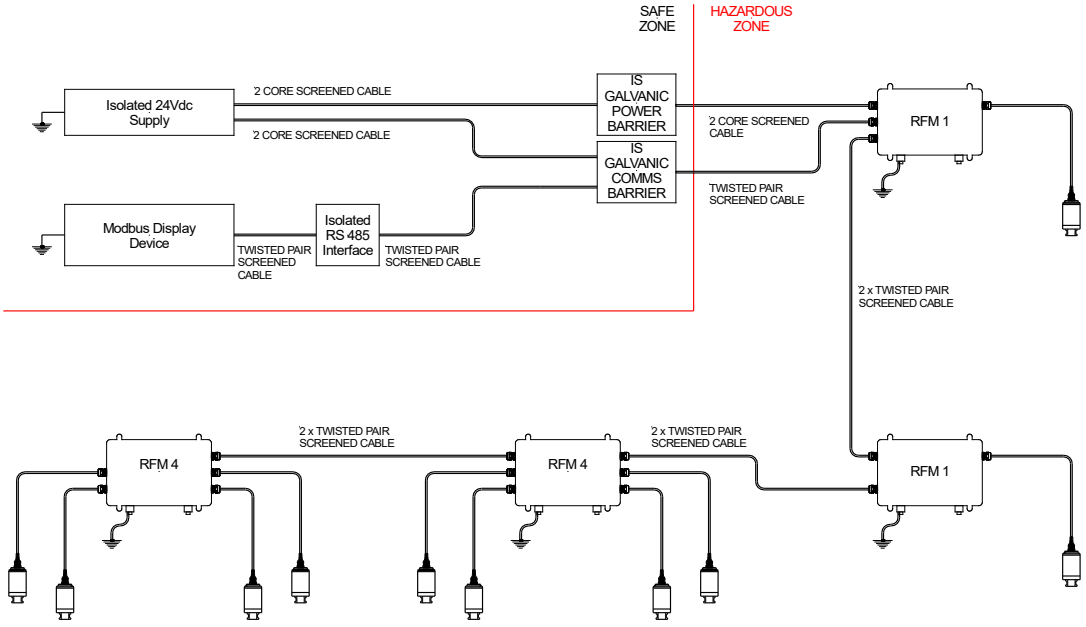
Single APT 1000 digital mode hazardous area using a Galvanic Isolator connection



Multiple APT 1000 digital mode hazardous area using a Zener Barrier connection



Multiple APT 1000 digital mode hazardous area using a Galvanic Isolator connection



Connecting the APT 1000 RS485 Modbus digital output to an RS485 Modbus Master

Connection to the Modbus Network Master will depend upon the hardware the Master is based upon. If the Master is a dedicated PLC or Acquisition Module then it is likely to have direct RS485 connectivity.

If connecting to a PC then it is more usual to use an interposing converter which takes RS485 signal in and converts to USB out for connection to the PLC. In this case we recommend using the following device

- EASYSYNC Isolated USB to RS-485 Convertor (ES-U-2101-M)

RS485 Communications Settings

9600bps, 8 data bits, No Parity, 1 stop bit

For details of the full functionality and functions supported by the Modbus connection refer to **Manual 088 APT 1000 Functionality & Communications Protocol**.

18.0 Network Cabling

Industry standards for a single RS485 Modbus network recommend that the total communications loop cabling should not exceed 1200 Metres. When calculating the total length both the integral cable from each sensor and the interconnecting cable between RFM modules must be included.

For example:

2 x APT 1000 each with 80 metres cable + 3 x with 25 metres cable

Total APT 1000 cable is 235 metres, leaving 965 metres for connection between all other devices.

Both Power (24V DC) and data (RS485) conductor pairs may be run in the same overall cable but the data conductors must be twisted pair configuration.

Power conductors may be twisted or an untwisted pair and the cable must have an overall braided screen.

PSM recommends a minimum conductor size 0.5mm and stranding to BS6360/IEC60228 class 5.

19.0 Use of terminating resistors

For RS485 networks, the two extreme ends of the network cable should have a termination resistor connected across the two wires. Without termination resistors, reflections of fast driver edges can cause multiple data edges that can cause data corruption. Termination resistors also reduce electrical noise sensitivity due to the lower impedance.

The APT 1000 has a switchable internal termination resistor that can be used.

PSM can provide the ISS software configuration tool to test the network performance if required.

If installing as part of a Modbus network please refer to Man 089 APT 1000 & RFM networks for further details.

20.0 APT 1000 Specifications

Specifications		
Materials	Sensor body	316L Stainless Steel or Titanium. Hastelloy C276 option for Wetted parts for external (to tank) mounting.
	Diaphragm	316L or Titanium to match body material. Hastelloy C276 process ports use Tantalum diaphragm.
Standard Measurement Ranges (Bar)	0.2, 0.5, 1.0, 2.5, 4.0, 10, 25, 40, 60. (Other ranges to special order)	
Measurement type	Vented Gauge or Absolute (Absolute version minimum range 1 bar)	
Overload	2 x Nominal range with no effect	
Burst Pressure	15 x Nominal range up to 10 Bar. 7 x Nominal range above 10 Bar	
Turndown	5:1 from Nominal range (relevant to 4-20mA scaling only)	
Temperature measurement span / accuracy	0 to +85°C +/- 1°C (reading only available in digital mode)	
Total Error Band (pressure monitoring	+/- 0.1% of Nominal range including thermal effect	
Thermal compensation	No thermal effect within the range 0 to 70°C	
Long term stability	Error not exceeding +/- 0.1% Per Annum	
Max / Min process temperature	-35 to +85°C	
IP Rating	IP68 suitable for continuous immersion	
IECEx certification	Refer to PSM for copies of current Certification	
ATEX certification	Refer to PSM for copies of current Certification	
Signal Output / Power supply	4-20mA & RS485 Modbus RTU / 10 to 30V DC	
Maximum load	Supply dependant. Vs-10/0.02 = Load in Ohms	
Reverse polarity protection	Yes	
Weight	0.3Kg typical for body. Cable 0.1Kg / metre	

21.0 APT 1000 Model Code

APT1000 Level / Pressure Transmitter

1000S	APT 1000 Dual Mode 4-20mA & RS485 Modbus Intelligent Transmitter - Submersible construction with cable
1000D	APT 1000 Dual Mode 4-20mA & RS485 Modbus Intelligent Transmitter - DIN Plug Type 43650 connection
1000H	APT 1000 Dual Mode 4-20mA & RS485 Modbus Intelligent Transmitter - Terminal Head

Certification

S	Hazardous Area Approval NOT APPLICABLE
I	Certified Intrinsically Safe to ATEX - Hazardous Area Approved
X	Certified Intrinsically Safe to IECEx - Hazardous Area Approved
IX	Dual Certification ATEX / IECEx - Hazardous Area Approved

Measurement Type

A	Absolute
G	Gauge

Nominal Range

	Absolute				Gauge			
	TI	**SS**	**HT**		**TI**	**SS**	**HT**
A	N/A	N/A	N/A	**A**	0.2 Bar	0.2 Bar	0.2 Bar
B	N/A	N/A	N/A	**B**	0.5 Bar	0.5 Bar	0.5 Bar
C	1.0 Bar	1.0 Bar	1.0 Bar	**C**	1.0 Bar	1.0 Bar	1.0 Bar
D	2.5 Bar	2.5 Bar	2.5 Bar	**D**	2.5 Bar	2.5 Bar	2.5 Bar
E	4.0 Bar	4.0 Bar	4.0 Bar	**E**	4.0 Bar	4.0 Bar	4.0 Bar
F	10 Bar	10 Bar	10 Bar	**F**	10 Bar	10 Bar	10 Bar
H	25 Bar	25 Bar	25 Bar	**H**	25 Bar	25 Bar	25 Bar
I	40 Bar	40 Bar	40 Bar	**I**	40 Bar	40 Bar	40 Bar
J	60 Bar	60 Bar	60 Bar	**J**	60 Bar	60 Bar	60 Bar

Process Connections & Fitting Options (not available for Ti versions)**

1	1/2" BSP Male (Standard connection). Material is as specified for the main body
2	3/4" BSP Male Adapter in 316 Stainless Steel
3	1" BSP Male Adapter in 316 Stainless Steel
4	DN25 PN16 316 Stainless Steel Flange
5	Special connection - refer for availability and cost
6	G1/2" to DIN EN837 (Special order, refer for delivery time)
7	Pole Adapter Threaded G 1/2" Female Adapter in 316 Stainless Steel**
8	Pole Adapter Threaded G 3/4" Female Adapter in 316 Stainless Steel**
9	1/2" BSP Male Process Connection / 3/4" BSP Male Head Adapter Back End
10	1/2" BSP Female Adapter in 316 Stainless Steel (ICT Retrofit)
11	St.Steel Sensor with Drain wire adapter
12	St.Steel Sensor with Stainless Steel Stilling Pipe Retainers
13	Not used
14	Titanium Sensor with Drain wire adapter
15	Titanium Sensor with Anti-rattle fins
16	Not used
17	Sensor body fitted with flexible pipe insertion cage (both St.Stl. and Ti bodies)

Cable Length mtrs (only applicable to APT 1000 versions)

**	Heavy Duty Vented Cable - 3 Metres included as standard
Q**	As above but cable outer jacket PTFE coated (Subject to Availability)
R**	As above but cable outer jacket Flame Retardant (Subject to Availability)
S**	As above but cable outer jacket FEP Coated (Subject to Availability)
Z**	Custom cable (refer to discuss requirements)

Transmitter Body Material

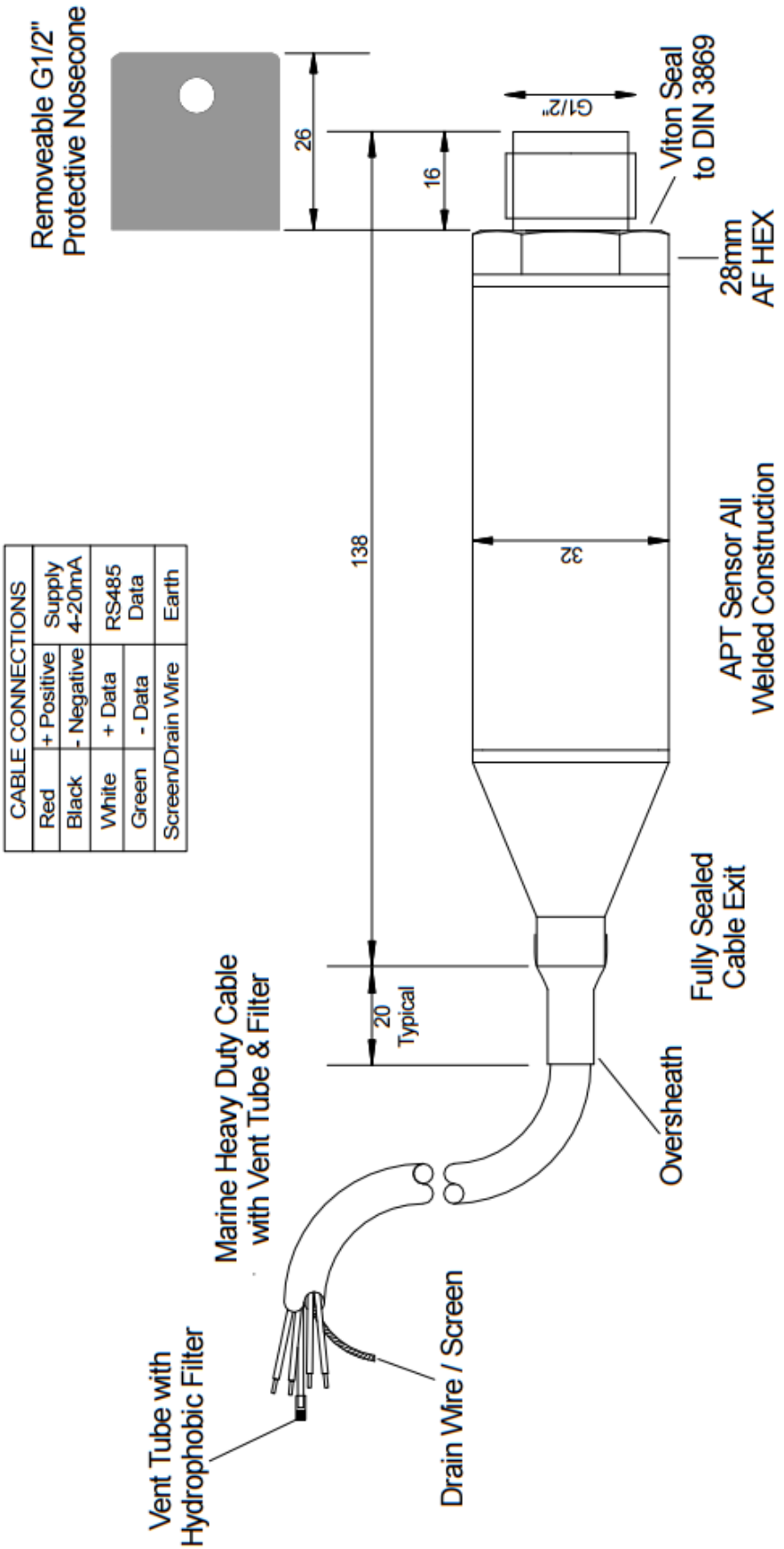
TI	Titanium (Body & Diaphragm)
SS	Stainless Steel (Body & Diaphragm)
HT	Hastelloy / Tantalum wetted parts (St. Stl. Body)

Transmitter Orientation

H	Horizontal
V	Vertical - Diaphragm facing down
U	Vertical - Diaphragm facing up

Example:	**1000S**	**S**	**A**	**E**	**1**	**30**	**TI**	**H**
Written as	**1000S/SA/E/1/30/TI/V**							

22.0 APT 1000 Dimensions



Contact PSM for adapters and fitting options

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