icountPDZ2

GB

Aviation icountPDZ2 User Manual

Parker

B.84.833_IPDZ2F_GB_Ver A

www.parkerhfde.com

Overview

Parker Hannifin's icountPDZ2 is an on-line laser particle detector that has been developed for detecting contamination in Avtur and other hydrocarbon fuels. This detector is designed for use in ATEX category 3 areas and is housed in a stainless steel IP69K approved enclosure.

The unit has two size 06L EO 24° cone-end fluid connections that allow the fuel to be transferred through the unit for analysis. The electrical supply and communication is made via two M12 Ultra Lock IP69K approved connectors.

Conditons for safe use

To ensure compliance with the certification, users are NOT permitted to open the unit under any circumstances. Doing so will invalidate the unit's calibration and it would NOT be suitable for Hazardous area use.

Contents

Laser Information

This product contains an invisible infrared 5mW laser.

Any dismantling of the product may result in dangerous exposure to laser radiation.

DANGER
INVISIBLE LASER RADIATION
WHEN OPEN. AVOID DIRECT
EXPOSURE TO BEAM.

CAUTION: Users are not required to access the laser radiation source and should never do so.

Declaration of Conformity and Certificate of Manufacture

CE conformity

The IPD Z2 is in conformity with the protection requirements of the following European Standards in English:

- Directive 94/9/EC of the European Parliament and the Council, for equipment intended for use in potentially explosive atmospheres (ATEX).
- EN 60079-0:2009, Electrical apparatus for explosive gas atmospheres General requirements.
- EN 60079-15:2005, Electrical apparatus for explosive gas atmospheres – Construction, test and marking of type of protection “n” electrical apparatus.
- EN 61241-1:2004, Electrical apparatus for use in the presence of combustible dust. Protection by enclosures ”tD”
- IECEx 60079-0:2006 ed 4.0 (IECEx 60079-0:2007 ed 5.0) – Electrical equipment for explosive gas atmospheres – Part 0: General requirements
- IECEx 60079-15 :2005 ed 3.0 – Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection ”n” electrical apparatus
- IECEx 61241-1:2004 ed 1: IECEx Test Report for IEC 61241-1 (2004) ed 1.0 – Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures “tD”

The Product(s) described above are in conformity with the essential requirements of the following directives:

89/336/EEC amended by 92/31/EEC, 93/68/EEC and repealed by 2004/108/EEC

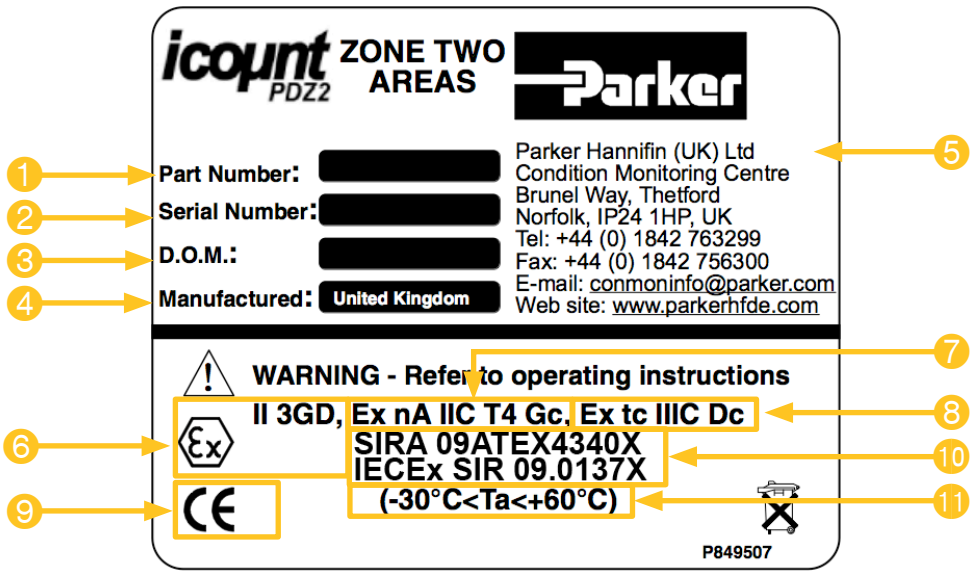
Harmonised standards:

EN61000-6-3:2007 Electromagnetic compatibility – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments.

EN61000-6-2:2005 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

Product identification label

The identification label attached to the enclosure (an example is given below) is explained in the table that follows:



Item	Field	Values
1	Part Number	icountPDZ2
2	D.O.M.	Date of manufacture
3	Serial Number	The serial number consists of eight digits, for example: **GD6NN001** ('**GD**' is the month and year; '**6NN**' is the product group; the last three digits are entered sequentially through a month, reverting to '**001**' at the beginning of each month)
4	Manufactured	Country of manufacture (United Kingdom)
5	Name and address of manufacturer	Parker Hannifin (UK) Ltd, Filter Division Europe, Condition Monitoring Centre, Brunel Way, Thetford, Norfolk, IP24 1HP, UK
6	ATEX certification number	**Ex** = European mark **II** = Non-mining **3** = Equipment category (Zone 2/22) **GD** = Type of explosive atmosphere (G = Gas, D = Dust)
7	ATEX/IECEx category 3 certificate coding (Gas)	**Ex** = Explosion protected **nA** = Type 'n' (non-sparking) **IIC** = Gas group **T4** = Temperature class (4 = maximum surface temperature of 135°C) **Gc** = Equipment protection level (G = Gas, c = Zone 2)
8	ATEX/IECEx category 3 certificate coding (Dust)	**Ex** = Explosion protected **tc** = Protection by enclosure **IIIC** = Equipment grouping typical dust material **Dc** = Equipment protection level (D = Dust, c = Zone 2)
9	CE Conformity marking and number of notified body responsible for audit production	**CE 0518**
10	Certificate Numbers	**SIRA 09ATEX4340X IECEx SIR 09.0137X**
11	Ambient operating temperature	Between -30°C and +60°C

Introduction

Parker Hannifin's icountPDZ2 represents the most up-to-date technology in solid particle contamination analysis. The icountPDZ2 is a compact, permanently-mounted laser-based particle detector module that provides a cost-effective solution to fluid management and contamination monitoring.

Principles of operation

The icountPDZ2 measures particle contamination continuously and updates the output options and limit relay every second.

Unlike the Parker CM20, LCM20 or MCM20, the unit does not perform a 'one-off' test. This means that even if the Measurement Period is set to 60 seconds, the output and limit relay all report the presence of dirt in the fuel in just a few seconds – it does not wait until the end of the Measurement Period before reporting the result.

The icountPDZ2 has just one setting to control the accuracy, stability and sensitivity of the measurements and that is the 'Measurement Period'. This can be set from 5 seconds to 180 seconds. The longer the Measurement Period, the more contaminant is measured, averaging out any spikes seen on a smaller sample. The shorter the Measurement Period, the more sensitive the icountPDZ2 is to small slugs of contaminant, but it can also reduce the performance on clean systems. Thus, the user can select how sensitive the icountPDZ2 is to spikes of contaminant, and how quickly it responds to contamination levels above the set point ('limits').

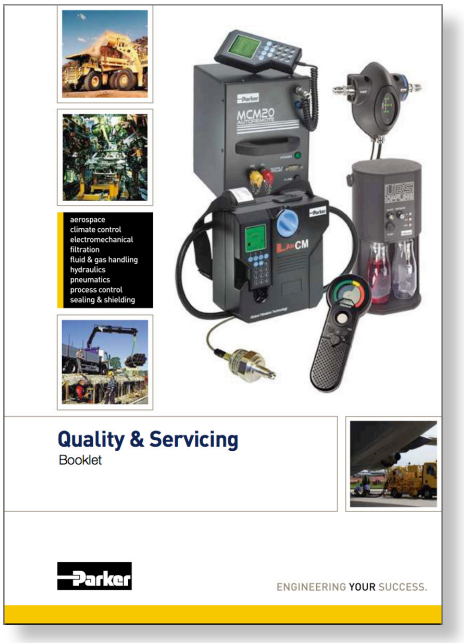
With a Measurement Period of 100 seconds, the results will be for the last 100ml of fuel that has flowed through the icountPDZ2, updated on a second-by-second basis, giving an effectively continuous readout of the level of contamination.

Calibration recommendations

NOTE: Any servicing or repair work must be carried out by a Parker ATEX approved service centre.

Contact your local Parker Hannifin Sales Company for recalibration details. The recommended period between recalibration is 12 months.

Please refer to the Parker Hannifin Quality and Servicing booklet (FDCB272UK), supplied on CD.



Benefits

- Independent monitoring of system contamination trends
- Calibration by recognised online principles confirmed by relevant International Organization for Standardization (ISO) procedures
- Indicators for Low, Medium and High contamination levels
- A low cost solution to prolonging fluid life and reducing machine downtime
- Self-diagnostic software
- Avtur and hydrocarbon fuel-compatible construction
- Fully PC/PLC integration technology such as: RS232, 0–3V/0–5V, 4–20mA and CAN-bus (SAE J1939) – see the ‘Product Configurator’, page 42, for communication options
- Manufactured from stainless steel and certified to SIRA 09ATEX4340X IECEx SIR 09.0137X.

Technical specification

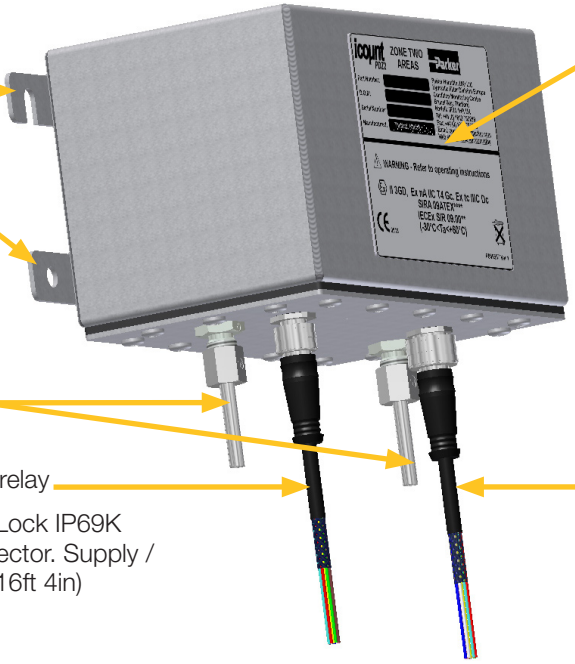
Feature	Specification
Product start-up time	5 seconds minimum
Measurement period	5–180 seconds
Reporting interval	0–3600 seconds via RS232 communication
Principle of operation	Laser Diode optical detection of actual particulates
International codes	ISO 7 – 22
Calibration	By recognised online methods confirmed by the relevant ISO procedures. **MTD** – Via a certified primary ISO 11171 automatic particle detector using ISO 11943 principles, with particle distribution reporting to ISO 4406:1996
Recalibration	Contact Parker Hannifin
Working pressure	2–420 bar (30–6000 PSI)
Flow range through icountPDZ2	**Note**: Flow may be bi-directional 40–140 ml/min (optimum flow 60 ml/min) (0.01 – 0.04 USGPM (optimum flow 0.016 USGPM))
Ambient storage temperature	–40°C to +80°C (–40°F to +176°F)
Environment operating temperature	-30°C to +60°C (–22°F to 140°F)
Fluid operating temperature	+5°C to +80°C (+41°F to 176°F)
Computer compatibility	Parker recommends the use of a 9-way D-type connector. This can be connected to a USB port using a USB-serial adaptor. Note that these connectors/adaptors are **NOT** supplied with icountPDZ2 units: contact Parker Hannifin for advice.
Operating humidity range	5% RH to 100% RH
Power requirement	Regulated 9–40Vdc
Current rating	Typically 120mA
Certification	IP69K rating EC Declaration of Conformity (see page 4).
Analogue output options (specified when ordering)	
Variable current	4–20mA
Variable voltage	0–5Vdc, 0–3Vdc (user selectable)
CAN-bus	to SAE J1939 (e.g. *Parker IQAN*)

Software default settings

Standard defaults	
Comms echo	OFF
Verbose errors	OFF
STI Sensors used	OFF (Do not set to 'ON' – contact Parker Hannifin for details)
Reporting standards	ISO
Particle limits	14 / 13 / 12 / 09
Measurement period	60 seconds
Reporting interval	30 seconds
Power-on mode	AUTO
Auto start delay	5 seconds
Date format	dd/mm/yy

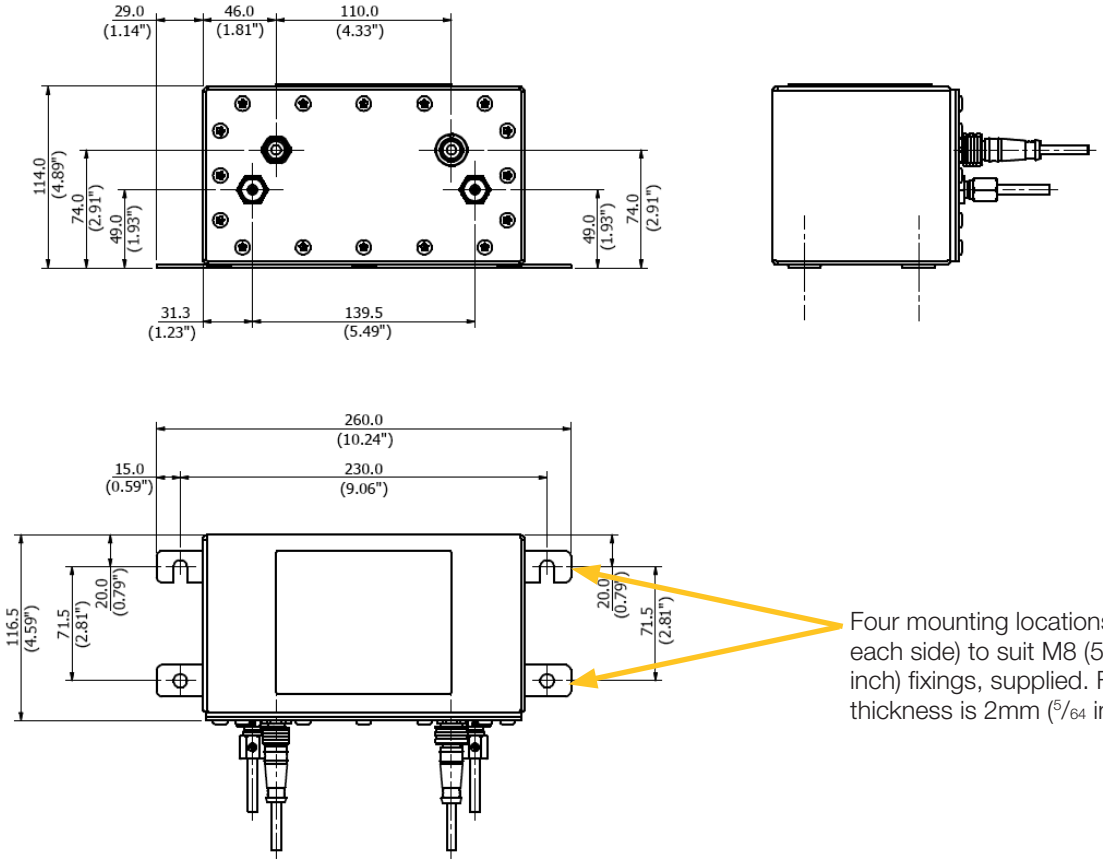
Default if options fitted	
Relay hysteresis	ON
Relay operation for particle limits	ON
0–5V/0–3V output voltage range	0–5V

Product features



Dimensions for installation

Dimensions are given in mm (inches)



Connections

Fluid connection

Our recommendation is to position the icountPDZ2 as close to the system output as possible whilst controlling the flow to the optimum 60ml/min. This then provides the highest pressure conditions, plus the fuel in this position is indicative of the reservoir's fluid condition.

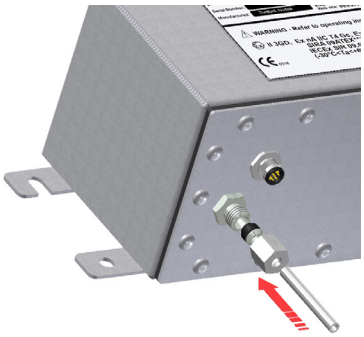
The IPDZ2 is supplied with two size 06L EO 24° cone-end fluid connections.

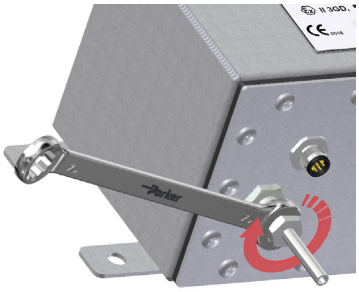
For fluid connection, ensure that the pipe connection fitting is compatible with the size 06L EO 24° cone bulkhead fitting.

Assembling the EO nut fitting

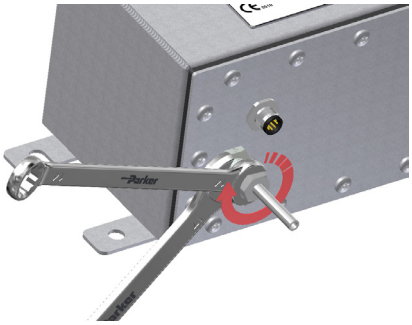
Step 1 Press the tube-end firmly into the assembly core.

Turn back the nut for easy tube insertion and fit the nut hand tight, then tighten the fitting until you feel a sharp increase in resistance.





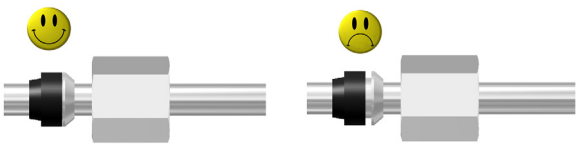
2 Ensure the bulkhead fitting is held with a 17mm spanner and tighten (approximately 1 to 1½ turns).



3 Now remove the pipe and nut to check assembly.

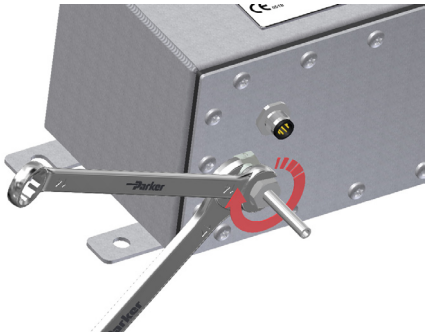
The gap between sealing ring and retaining ring must be closed. A little relaxation (approximately 0.2mm) is allowed.

If the gap is not closed: Check all components, including the tube.



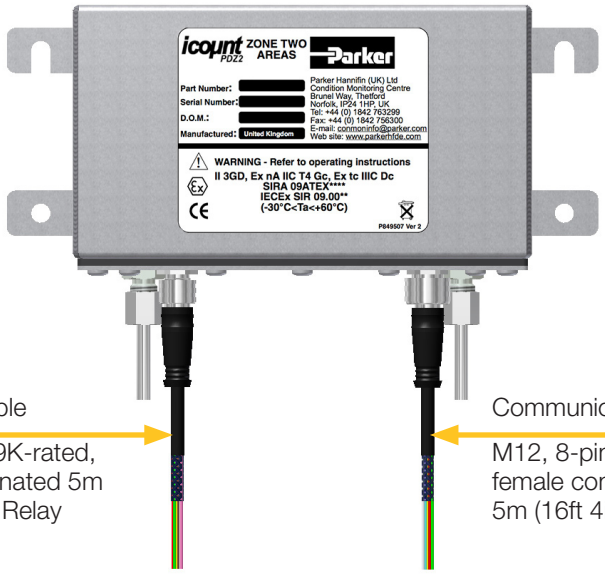
4 Assemble the fitting until wrench-tight (without spanner extension).

Tighten the fitting firmly by a minimum 1/6 (max ¼) turn (i.e. 1 to 1½ flats)



Electrical connections

The M12 8-pin Ultra Lock connection system uses innovative push-to-lock technology to make a quick but secure connection. The unique O-ring radial seal is operator-independent, so there is no chance of over-tightening or under-tightening.



Supply and Limit Relay cable

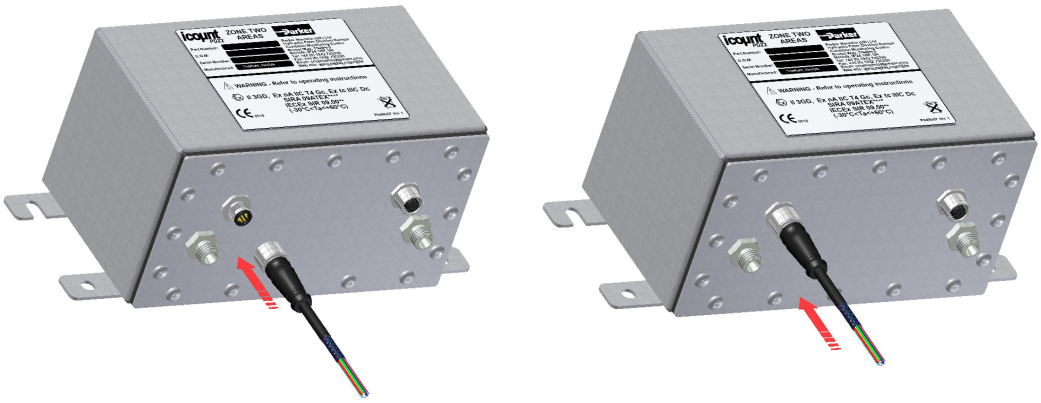
M12, 8-pin Ultra Lock IP69K-rated, male connector to unterminated 5m (16ft 4in) Supply and Limit Relay cable.

Communication cable

M12, 8-pin Ultra Lock IP69K-rated female connector to unterminated 5m (16ft 4in) Communication cable.

IMPORTANT NOTE: The IP69K Ingress Protection is only valid when using the M12 Ultra Lock mating connector cable (supplied).

CONNECTING/DISCONNECTING



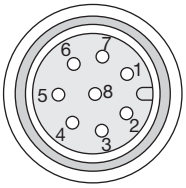
Ensure that the locating pin and slot are correctly aligned (to avoid damaging the pins) and push home firmly to connect. To disconnect, pull the Ultra Lock's metal collar back to release the cable lock and pull the cable boot out squarely.

WIRING DIAGRAMS

Wiring diagrams are provided (on pages 15–17), showing how a digital multimeter may be connected to the Communication cable and the Supply and Limit Relay cable, for both voltage and current options. The connections for an optional moisture sensor (if fitted) are also shown.

A diagram for connecting the icountPDZ2 to an external CAN-bus network is given on page 18.

Communication cable connector

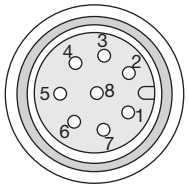


Pin configuration diagram
M12, 8-pin Ultra Lock IP96K female connector, end view

Pin number (Wire colour recommended)	No options fitted	4–20mA option fitted	0–5V/0–3V option fitted	CAN-bus option fitted
1 (White)	NOT USED	Channel C, ISO 14µm(c)	Channel C, ISO 14µm(c)	NOT USED
2 (Brown)	RS232 Ground (* Pin 5)	RS232 Ground (* Pin 5)	RS232 Ground (* Pin 5)	RS232 Ground (* Pin 5)
3 (Green)	NOT USED	Channel A, ISO 4µm(c)	Channel A, ISO 4µm(c)	CAN+ (Hi)
4 (Yellow)	NOT USED	Channel B, ISO 6µm(c)	Channel B, ISO 6µm(c)	CAN– (Lo)
5 (Grey)	RS232 Receive (* Pin 3)	RS232 Receive (* Pin 3)	RS232 Receive (* Pin 3)	RS232 Receive (* Pin 3)
6 (Pink)	RS232 Transmit (* Pin 2)	RS232 Transmit (* Pin 2)	RS232 Transmit (* Pin 2)	RS232 Transmit (* Pin 2)
7 (Blue)	NOT USED	Channel D, ISO 30µm(c)	Channel D, ISO 30µm(c)	CAN Ground
8 (Red)	NOT USED	NOT USED	NOT USED	NOT USED

** Parker Hannifin recommends the use of a 9-way D-type socket with RS232, using the pin configurations given in the above table.*

Supply and Limit relay cable connector

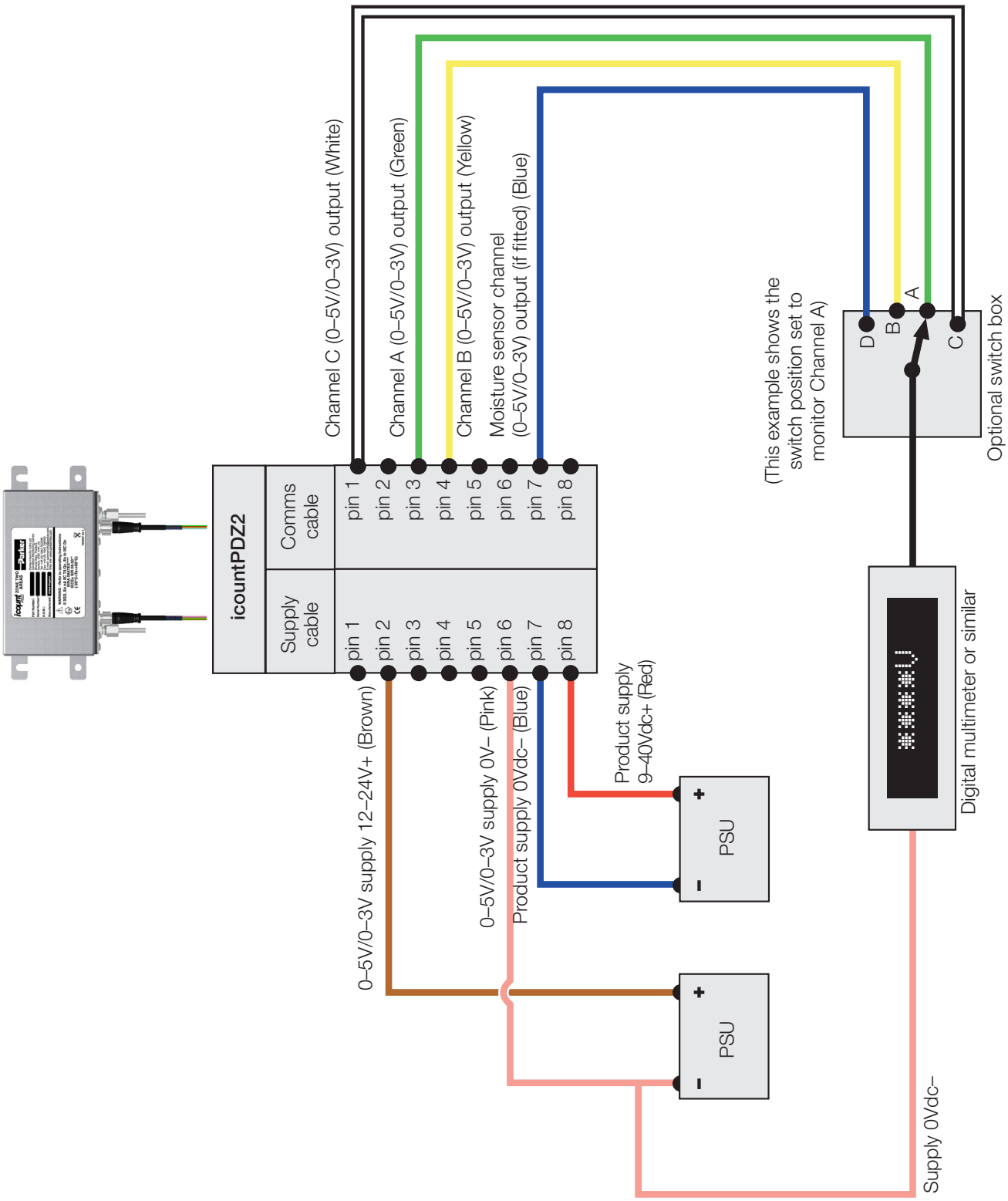


Pin configuration diagram
M12, 8-pin Ultra Lock IP69K-rated, male connector, end view

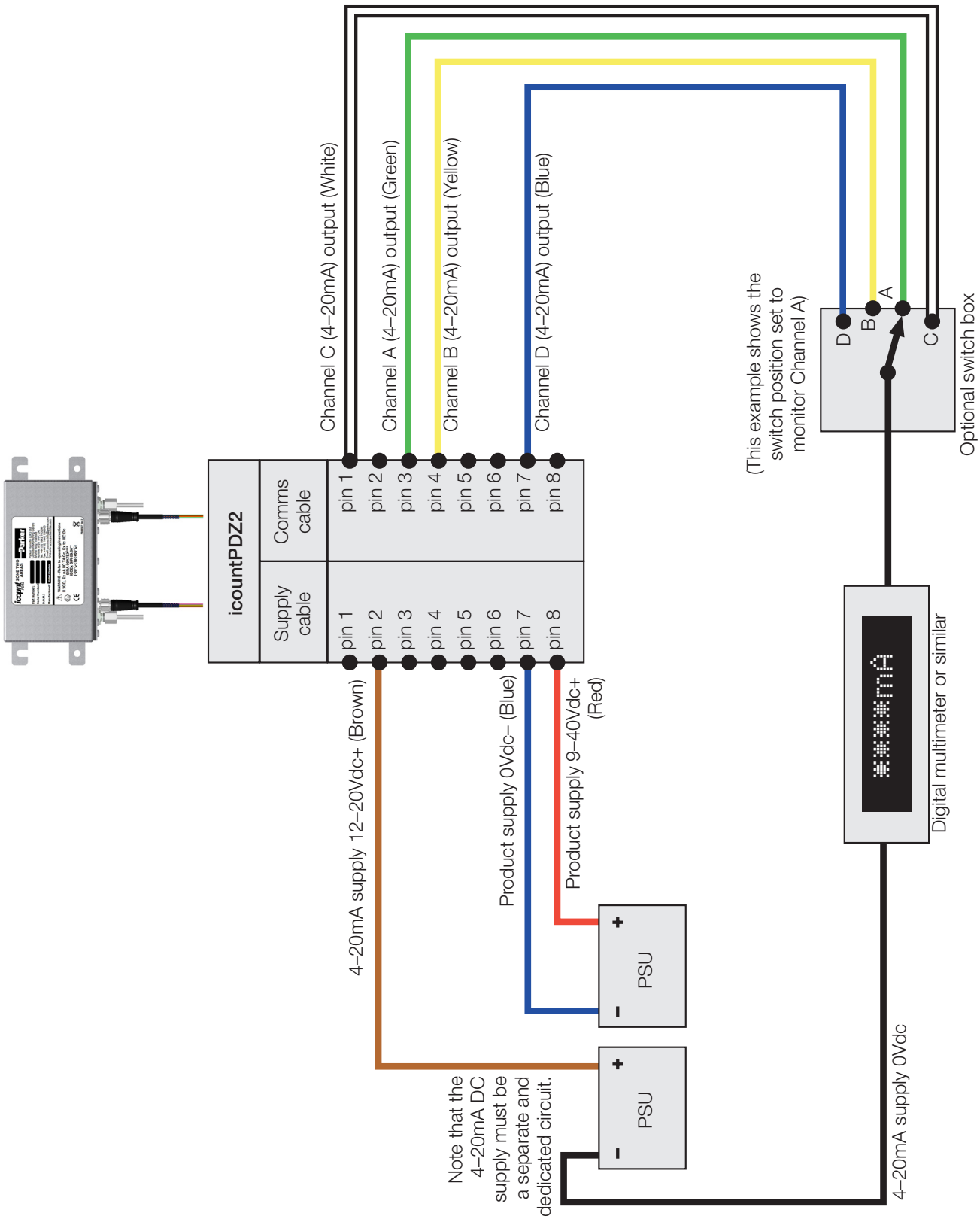
Pin number (Wire colour recommended)	No options fitted	4–20mA option fitted	0–5V/0–3V option fitted	CAN-bus option fitted
1 (White)	Relay Normally Closed (if fitted)	Relay Normally Closed (if fitted)	Relay Normally Closed (if fitted)	NOT USED
2 (Brown)	NOT USED	4–20mA Supply 12–20Vdc	0–5 / 0–3V Supply 12–24Vdc	NOT USED
3 (Green)	Relay Common (if fitted)	Relay Common (if fitted)	Relay Common (if fitted)	NOT USED
4 (Yellow)	Relay Normally Open (if fitted)	Relay Normally Open (if fitted)	Relay Normally Open (if fitted)	NOT USED
5 (Grey)	NOT USED	NOT USED	NOT USED	NOT USED
6 (Pink)	NOT USED	NOT USED	0–5V / 0–3V Supply 0 Vdc	NOT USED
7 (Blue)	Product supply 0Vdc	Product supply 0Vdc	Product supply 0Vdc	Product supply 0Vdc
8 (Red)	Product supply 9–40Vdc	Product supply 9–40Vdc	Product supply 9–40Vdc	Product supply 9–40Vdc

IMPORTANT NOTE: It is the responsibility of the end user to ensure that the cable's braided screen is terminated to a suitable earth bonding point.

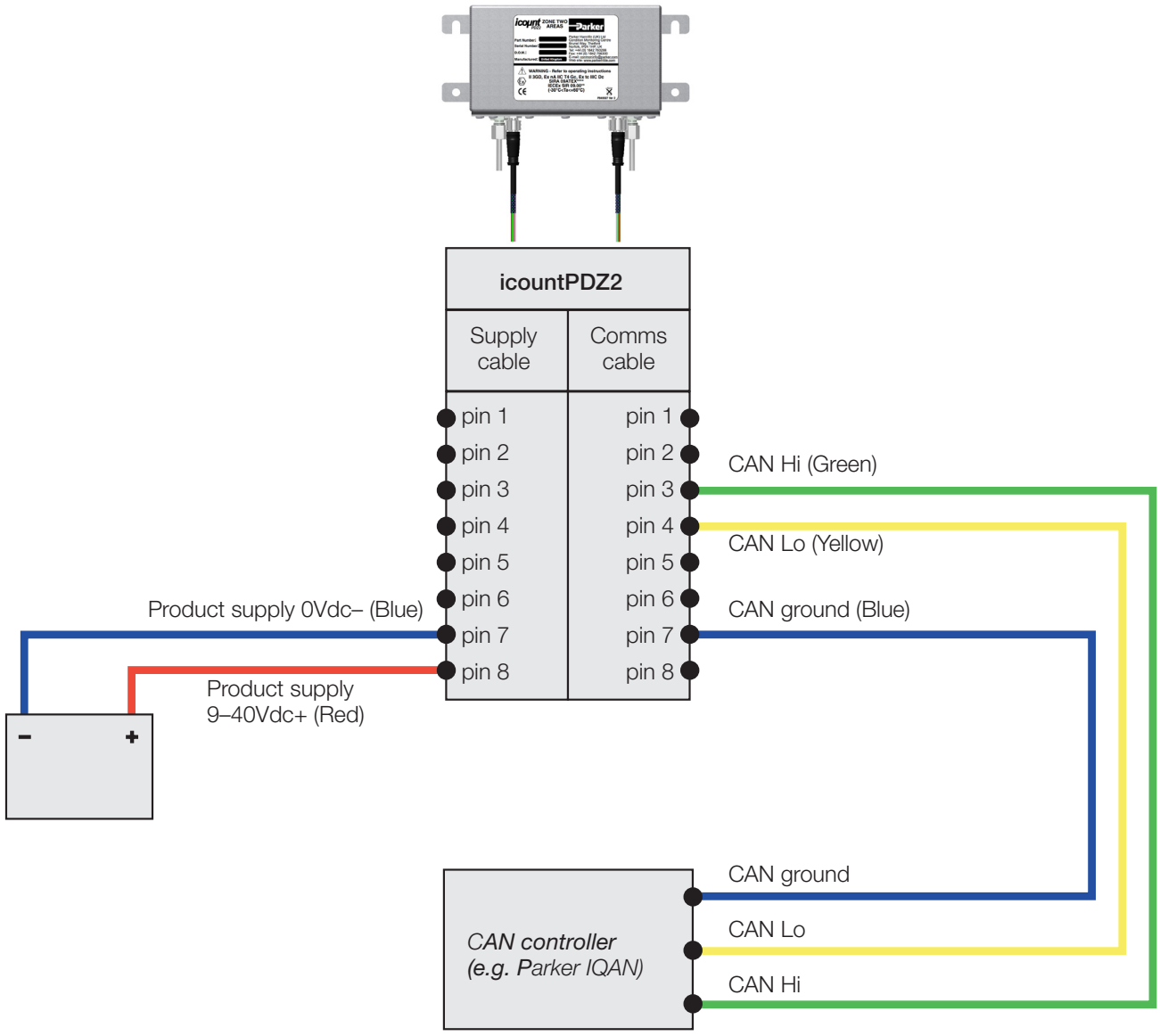
M12, 8-pin connector: 0–5V/0–3V voltage measurement



M12, 8-pin connector: 4–20mA current measurement



CAN-bus (SAE J1939) connections



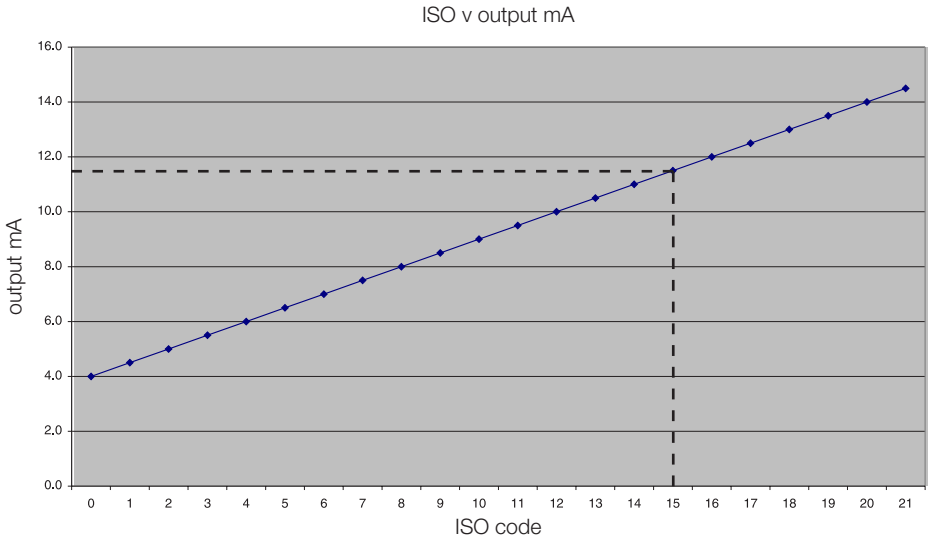
Variable current output settings

ISO setting

The following table can be used to relate an analogue output (in mA) to an ISO code. For example, an output of 10mA is equal to an ISO code 12.

mA	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0
ISO	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

cont.	**mA**	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20
	ISO	17	18	19	20	21	22	*	*	*	*	*	*	*	Over-range		ERROR



The actual calculation is as follows:
ISO code = (output in mA – 4) x 2

e.g. (11.5mA – 4) x 2 =
7.5 x 2 = ISO 15

* = Saturation (i.e. above ISO code 22)

Variable voltage output settings

The variable voltage output option is capable of two different voltage ranges: a 0–5Vdc range as standard, and a user-selectable 0–3Vdc range. The 'Full list of commands' section of this manual (page 30–32) gives information on how to change the voltage output range.

The following tables can be used to relate the analogue output to an ISO code.

For example, in a 0–5Vdc range, ISO code 16 is equal to an output of 3.5Vdc. In a 0–3Vdc range, ISO code 8 is equal to an output of 1.0Vdc.

Table relating ISO codes to Voltage output

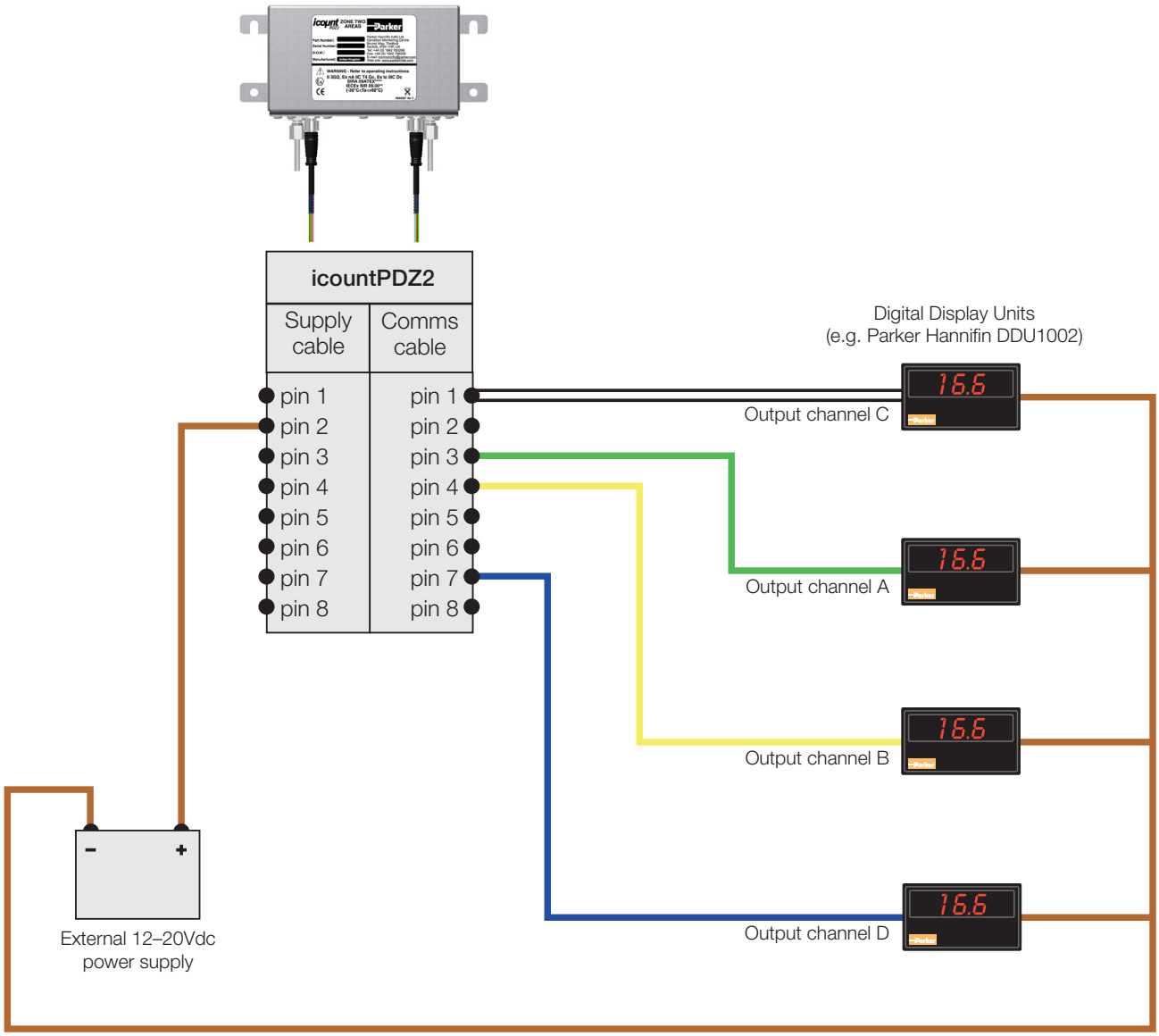
ISO	Err	0	1	2	3	4	5	6	7	8	9	10	11
0–5Vdc	<0.2	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
0–3Vdc	<0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3

cont.	ISO	12	13	14	15	16	17	18	19	20	21	22	Err
	0–5Vdc	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	>4.8
	0–3Vdc	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	>2.45

CAN-bus output option

If you plan to use the icountPDZ2 with a CAN-bus (SAE J1939) network, you can order this output option when specifying the unit. Refer to the 'Product configurator' (page 46) in the Reference section of this manual. The CAN option provides an interface to external CAN-bus networked systems – for example, to the *Parker IQAN*.

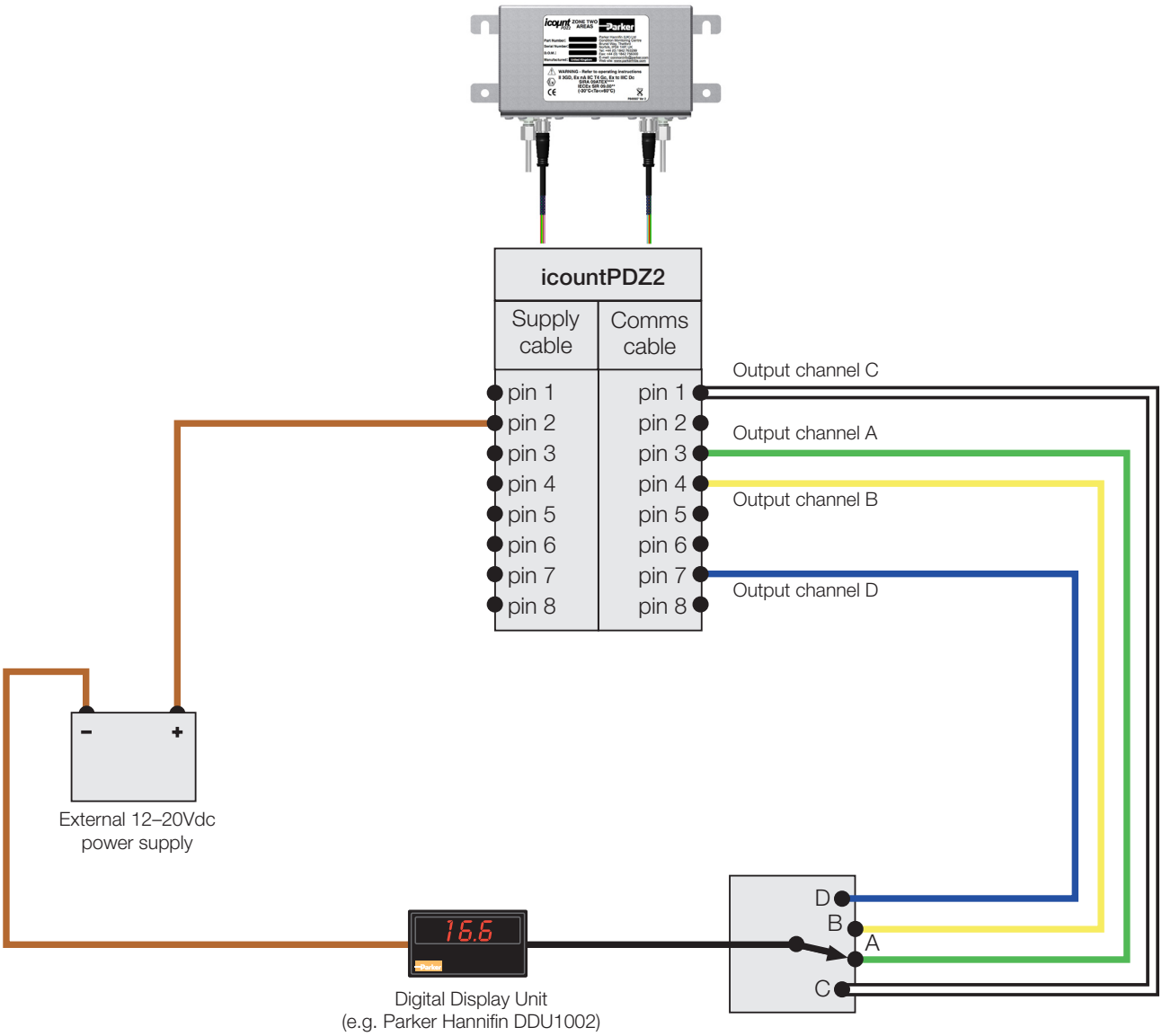
Digital Display Unit connection



The above diagram shows how a set of Parker Hannifin DDUs can be used to display Channels A, B, C and D.

DIGITAL DISPLAY UNITS AVAILABLE

Part number	Description
DDU1001	Process indicator, 22–55Vdc
DDU1002	Process indicator, 90–264Vdc



The above diagram shows how a single DDU can be used to display Channels A, B, C and D, by using a switch to display each channel in turn.

RS232 connection

Communication can be established between icountPDZ2 and a PC using an RS232 serial connection with the **Parker Utility Setup Tool**, the **Parker Terminal** utility, or via Microsoft Windows® **HyperTerminal**.

Please note that **HyperTerminal** is not supplied with Windows Vista™, but the **Parker Utility Setup Tool** and **Parker Terminal** can be used with this operating system. Both Parker programs are supplied on the icountPD CD.

PC connection

The RS232 wires need to be connected to a 9-way D-type connector (not supplied as standard). For the connector pin termination and wire colour, refer to the 'Communication cable connector' section of this manual (page 15).

The device can then be either connected direct to PC serial port (Figure 1) or connected via an RS232-to-USB adaptor cable (Figure 2).

An RS232 to USB convertor can be supplied by Parker Hannifin (part number ACC6NN017).

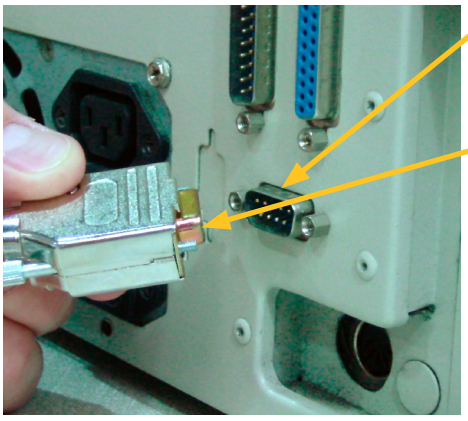


Figure 1

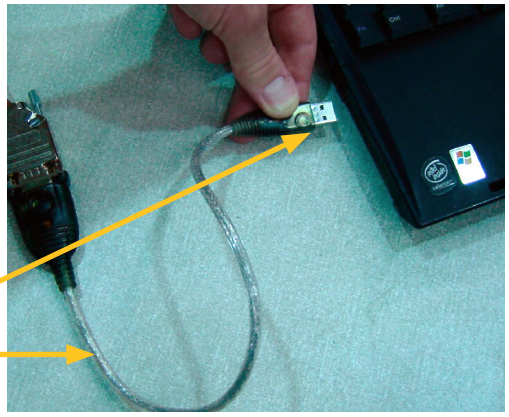


Figure 2

NOTE: The 9-way D-type connector, RS232-to-USB adaptor cable and installation software are not supplied as standard with the icountPDZ2.

Software

The icountPDZ2 may be configured using the **icountPD Setup Utility**, supplied on CD.

For more direct control of the device using its communications protocol, you may use the **Parker Terminal** program: both Parker programs are supplied on the icountPDZ2 CD. You may also use Microsoft Windows® **HyperTerminal** program, but note that this program is not currently supplied with the Windows Vista™ operating system.

icountPD Setup Utility software

PC Installation

The icountPD Setup Utility and Parker Terminal software is available on the CD supplied with the icountPDZ2. The software can be run directly from the CD or copied to a PC hard drive.

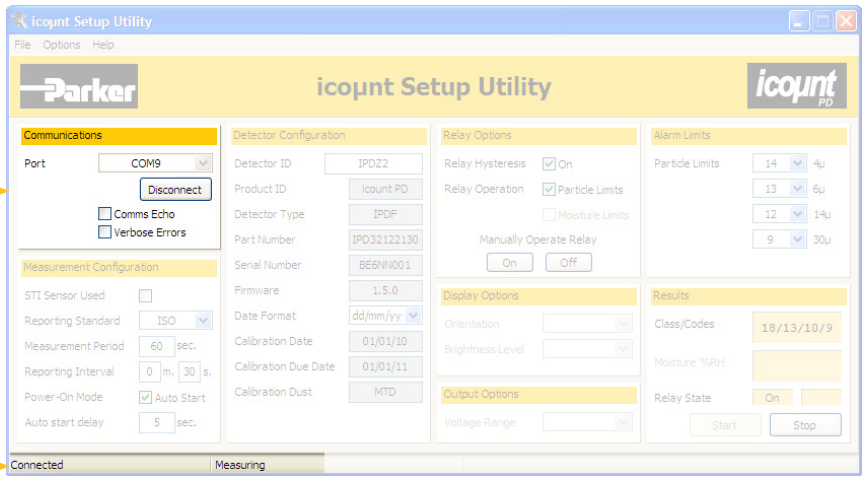
Using the icountPD Setup Utility

Check that the icountPDZ2 is connected to power and the communication cable is connected to the PC via the RS232 plug.

Place the CD in your PC drive and wait for the selection screen to appear. On starting the software, the icountPD Setup Utility screen appears.

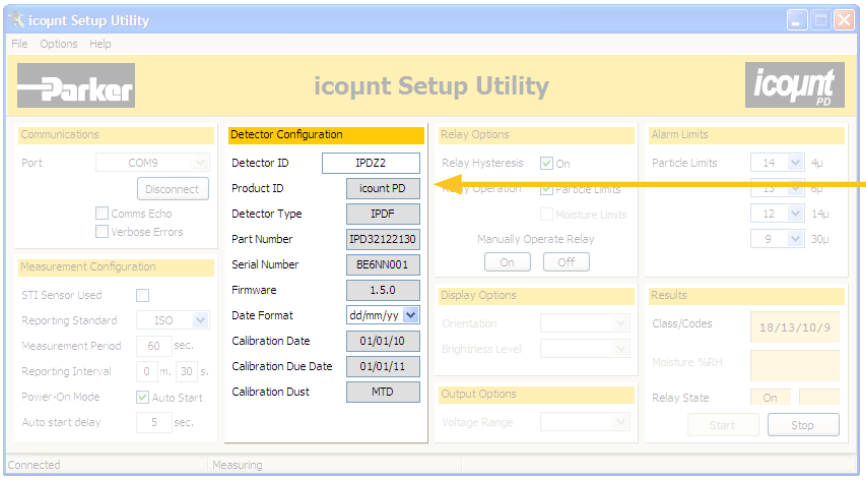
Step 1A:

With the icountPDZ2 connected to power and the RS232 connected to the PC, select the appropriate communication port.



Step 1B:

Note the status of the icountPDZ2.



Step 2:

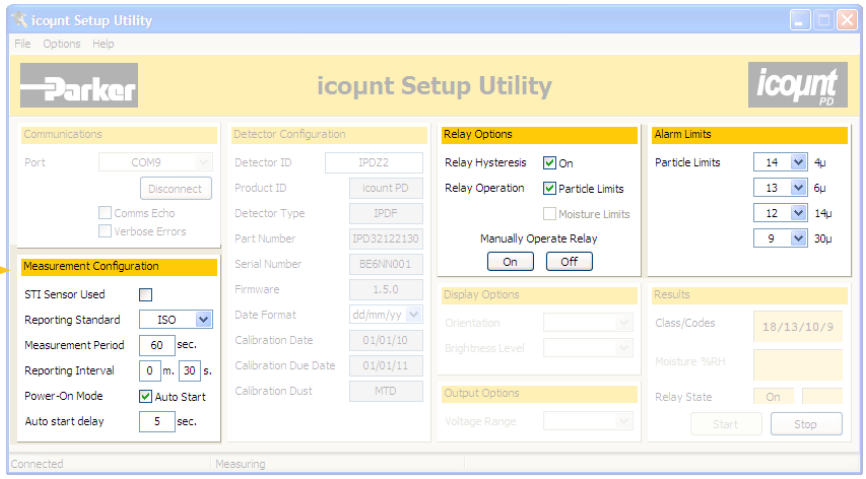
Set the values for ‘Detector ID’ and ‘Date Format’.

The remaining detector information is preset by Parker Hannifin and cannot be changed.

Step 3:

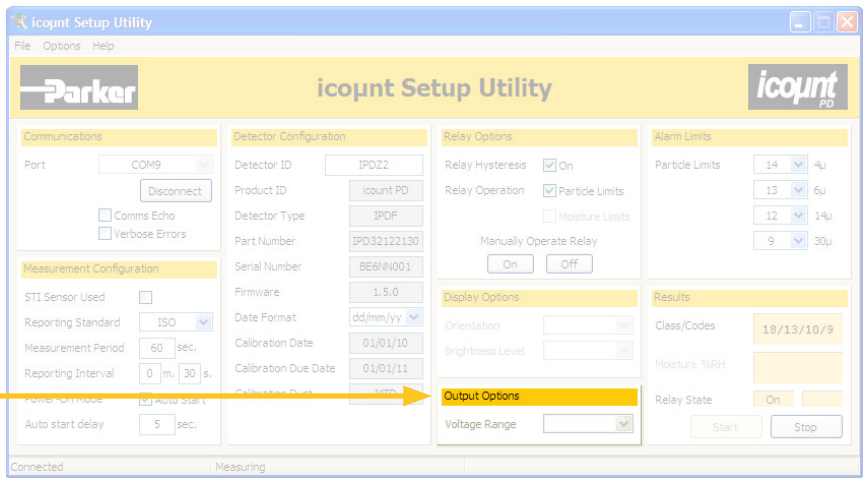
Set the values in ‘Measurement Configuration’, ‘Relay Options’ and ‘Alarm Limits’.

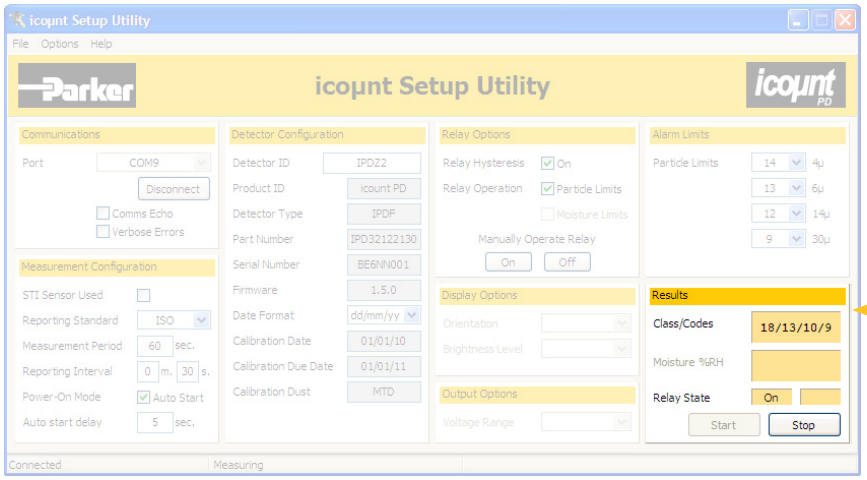
Ensure that ‘STI Sensor Used’ is not ticked (contact Parker Hannifin for details).



Step 4:

Set the Voltage Range (0–5V, 0–3V or J1939) in ‘Output Options’ according to the options fitted.





Step 5:

Setup values are verified as valid in ‘Results’.

Click ‘Start’ to start verification and ‘Stop’ to stop.

Microsoft Windows® HyperTerminal connection

An alternative way of achieving communication with icountPDZ2 is to use the HyperTerminal program supplied with Microsoft Windows (but not always installed on the PC or laptop's hard disk – check the installation disk, or contact your organisation's IT department if the program is not present). **Please note that HyperTerminal is not supplied with Windows Vista™, but the Parker Terminal utility can be used with this operating system**.

The standard communication settings (used in STEP 4) are as follows:

Baud Rate	9600
Data bits	8
Parity	None
Stop bits	1
Flowcontrol	None

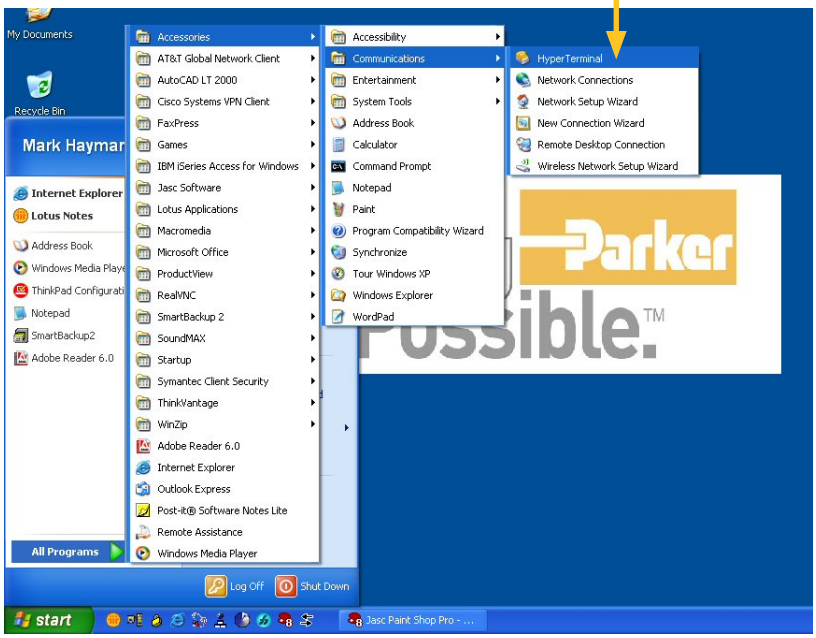
Step 1:

Click 'Start'

Step 2:

Select 'HyperTerminal'.

(from All Programs
- Accessories
- Communications
- HyperTerminal)



Step 3:

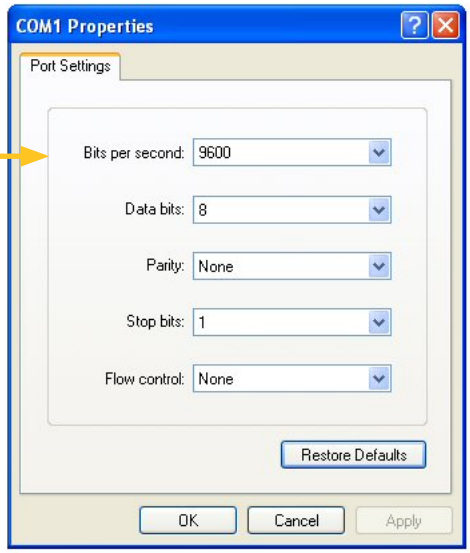
Click and type the connection name you wish to use to identify this session

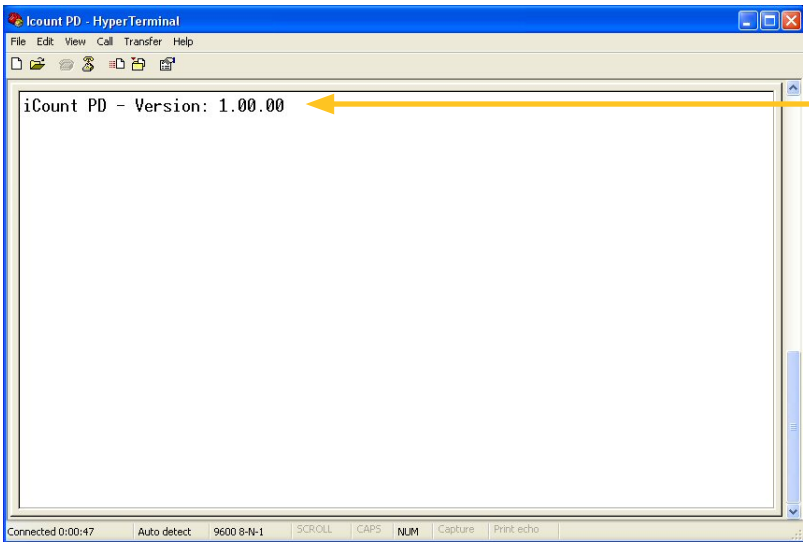
Step 4:

Select the appropriate USB port.

Step 5:

Enter the communication settings (as in the 'standard communications settings' table, on the previous page).





Step 6:

Once the icountPDZ2 is connected to power, the product identification is displayed.

This confirms that communication to icountPDZ2 has been established and the unit is now ready for operation.

Communication protocol

The commands used with the icountPDZ2 are either made up of Set, Read or Start/Stop commands.

- Set commands allow the value or values of parameters to be changed
- Read commands allow the value or values of parameters to be read
- Start/Stop commands allow the user to start and stop tests.

Example:

[SDF dd/mm/yy] sets the date format
[RDF] reads the product format date

All commands are sent in ASCII characters, and the protocol accepts both upper and lower case characters. For example, all of the following codes are equivalent:
SDF = Sdf = SDf = sdF = sdf

NOTE: The use of a '=' after a command, for example [SDF = dd/mm/yy], is optional.

Certain commands are for expert use only and can be accessed via a password system. Should an unauthorized person attempt to access these commands the icountPDZ2 returns the error code for 'Invalid Command'.

A list of error codes is given on page 33.

Most-used commands

Common User Read commands		
Command	**Description**	**icountPDZ2 response**
RDU	Read calibration dust	Calibration dust displayed (MTD)
RLT	Read ISO limits	Limits displayed
RRS	Read reporting standard	ISO

Common User Set commands		
Command	**Description**	**User response**
SLT	Set limits i.e. 'SLT 14 13 12 9'	SLT ## ## ## ## (for ISO)
SRS	Set reporting standard	SRS iso
SRI	Set reporting interval 0 to 3600 seconds 0 = No reporting	SRI ####

NOTE: The reporting interval (SRI) controls how often the icountPDZ2 sends results over the RS232.

User Start/Stop commands		
Command	**Description**	**Response**
STR or START	Start testing	'OK' displayed
STP or STOP	Stop testing	'OK' displayed

Full list of commands

User Read Commands		
Command	**Description**	**icountPDZ2 response**
RCD	**R**ead the last **C**alibration **D**ate	Last calibration date displayed
RCE	**R**ead **C**ommunication Echo	'ON' or 'OFF' displayed
	Comms Echo ON allows the icountPDZ2 to communicate in two directions (Hyperterminal) *Comms Echo OFF allows the icountPDZ2 to communicate in one direction (Setup Utility)*	
RDD	**R**ead the next calibration **D**ue **D**ate	Next calibration due date displayed
RDF	**R**ead **D**ate **F**ormat	Date format displayed (e.g. dd/mm/yy)
RDI	**R**ead **D**etector **I**D	Detector ID displayed
RDS	**R**ead **D**etector **S**tatus	IPD status displayed (e.g. RUNNING)
RDU	**R**ead the calibration **D**ust **U**nit	Calibration dust displayed (MTD)
REN	**R**ead last **E**rror **N**umber	Last error number displayed
RER	**R**ead last **E**rror text **R**eport	Last error text displayed
REV	**R**ead the **E**rror **V**erbose mode	Error verbose mode displayed
	Error Verbose ON displays the full description of the error code (i.e. Error 40 – expected On or Off) *Error Verbose OFF displays just the error code (i.e. Error 40)*	
RFN	**R**ead **F**ault **N**umber	Fault number displayed
RJE	**R**ead **J**1939 Status	'ON' or 'OFF' displayed
RLR	**R**ead the **L**ast contamination **R**esult	Last contamination result displayed
RLT	**R**ead contamination **L**imit **T**hreshold	Contamination limits displayed
RMP	**R**ead **M**easurement **P**eriod	Measurement period displayed
ROF	**R**ead **O**ptions **F**itted	ROF = ABCDEFGHIJ (see list of options below)
RON	**R**ead **O**ption **N**ame	List of options A = Alarm relay option B = LED display option C = OLED display option D = Moisture sensor option E = 4–20mA current loop option F = 0–3/0–5V option G = J1939 option H = reserved I = reserved J = reserved
RPD	**R**ead the **P**ower on hold-off **D**elay	Power hold-off delay displayed
RPI	**R**ead **P**roduct **I**dentifier	icountPDZ2 displayed
RPM	**R**ead the **P**ower on **M**ode	'AUTO' or 'MANUAL' displayed
RPN	**R**ead the icountPDZ2 **P**art **N**umber	Parker part number displayed
RPT	**R**ead **P**roduct **T**ype	IPDF
RPV	**R**ead **P**rotocol **V**ersion	Protocol version displayed
RRI	**R**ead **R**eporting **I**nterval	Reporting interval displayed
RRS	**R**ead **R**eporting **S**tandard	'ISO' displayed
RSB	**R**ead Software Build number	Software build number displayed
RSH	**R**ead limit relay **S**witch **H**ysteresis [1]	'ON' or 'OFF' displayed
RSL	**R**ead **S**tandards **L**ist	ISO
RSN	**R**ead **S**erial **N**umber	Serial number displayed
RSS	**R**ead limit relay **S**witch **S**tate [1]	'ON' or 'OFF' displayed
RSU	**R**ead STI **S**ensor **U**sed	'YES' or 'NO' displayed

RSV	**R**ead **S**oftware **V**ersion displayed	Software version displayed
RVM	**R**ead the **V**oltage **M**aximum range [2]	Voltage range displayed
RWC	**R**ead **W**arning limit relay for **C**ontamination [1]	'ON' or 'OFF' displayed

[1] Command requires a Limit Relay to be fitted to icountPDZ2
[2] Command requires a 0–5V option to be fitted to icountPDZ2

User Set Commands		
Command	**Description**	**icountPDZ2 response**
SCE	**S**et **C**ommunication **E**cho	SCE on SCE off
	Comms Echo ON allows icountPDZ2 to communicate in two directions (Hyperterminal) *Comms Echo OFF allows icountPDZ2 to communicate in one direction (Setup Utility)*	
SDF	**S**et **D**ate **F**ormat	SDF dd/mm/yy SDF mm/dd/yy SDF yy/mm/dd
SDI	**S**et **D**etector **I**D	SDI ############### (14 characters maximum, spaces not allowed)
SEV	**S**et the **E**rror **V**erbose mode	SEV on SEV off
	Error Verbose ON displays the full description of the error code (i.e. Error 40 – Expected On or Off) *Error Verbose OFF displays just the error code (i.e. Error 40)*	
SJE	**S**et **J**1939 Status	SJE On/Off (can only set On)
SLT	**S**et contamination **L**imit **T**hreshold	SLT ## ## ## (for ISO)
SMP	**S**et **M**easurement **P**eriod	SMP ### (### = 5 to 180 seconds)
	The Measurement period sets the number of seconds the detector uses to determine the contamination levels. So if this is 60 seconds, the unit will use the last 60 seconds of fuel to determine the contamination level. (See the 'Component cleanliness guideline' chart in the Reference section of this manual.)	
SPD	**S**et the **P**ower on hold-off **D**elay	SPD ### (### = 5 to 900 seconds)
	The Power-on hold-off delay command allows the user to delay the start of the icountPDZ2 operation.	
SPM	**S**et the **P**ower on **M**ode	SPM auto SPM manual
	With the Power-on Mode set to 'Auto' icountPDZ2 starts testing automatically when the power is connected using the last setup parameters. With the Power-on Mode set to 'Manual' icountPDZ2 becomes idle and requires the user to manually start testing.	
SRI	**S**et **R**eporting **I**nterval	SRI mm:ss (0 to 3600 seconds (i.e. 0–1 hour); note that 0 = No reporting)
	The Reporting Interval controls how often icountPDZ2 sends results over the RS232	
SRS	**S**et **R**eporting **S**tandard	SRS iso
SSH	**S**et limit relay **S**witch **H**ysteresis [1]	SSH on SSH off
SSS	**S**et limit relay **S**witch **S**tate [1]	SSS on SSS off
SSU	**S**et STI **S**ensor **U**sed	SSU yes SSU no

SVM	**S**et the **V**oltage **M**aximum range [3]	SVM # (3 = 0–3Vdc output 5 = 0–5Vdc output)
SWC	**S**et **W**arning limit relay for **C**ontamination [1, 3]	SWC on SWC off

[1] Command requires a Limit Relay to be fitted to the icountPDZ2

[2] Command requires a 0–5Vdc option to be fitted to the icountPDZ2

[3] If the Limit Relay has been turned OFF the Limit Relay will not operate, but the alarm status is not affected.

If the Limit Relay has been turned ON the Limit Relay will operate when any alarm condition is reached.

Error codes

If a command does not follow the protocol, an explanatory error code is returned.

Depending on the setting of *SEV* (**S**et the **E**rror **V**erbose mode), either the error code, or the error code and message are displayed.

For example, with SEV OFF (Error Verbose off) just the error code (e.g. Error 40) is returned. With SEV ON (i.e. Error Verbose on) both the error code and message (e.g. Error 40 - Expected On or Off) are returned.

Messages corresponding to the error codes are given in the following table:

Code	Message
Error 0	No error
Error 1	Unknown command
Error 2	Characters after command ignored
Error 3	Command ignored – unit is busy
Error 5	Unexpected character found
Error 6	Symbol too long
Error 7	Bad command format
Error 8	Unknown value
Error 9	Invalid date format
Error 10	Invalid date
Error 13	Option not fitted
Error 14	String too short
Error 15	String too long
Error 17	No test result
Error 18	Number expected
Error 19	Number too long
Error 20	Number out of range
Error 30	Interval shorter than duration
Error 40	Expected On or Off
Error 41	Expected Disabled or Enabled
Error 43	Expected Auto or Manual
Error 45	Expected Yes or No

Reference

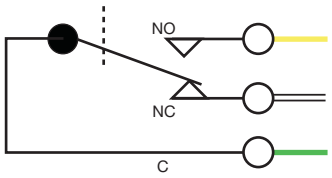
Optional wiring configuration

Supply and Limit Relay cable wiring configuration

The icountPDZ2 can be specified to include a built-in limit switch relay which can be triggered when a preset alarm level is reached. The relay contacts can be used to switch an external device on or off.

These wires within the icountPDZ2 Supply and Limit Relay cable may be identified by their colour: Yellow, White and Green, and are connected according to the diagram below.

Wire colour	Description
Yellow	Normally Open
White	Normally Closed
Green	Common



The contact rating is 5A at 5–24Vdc

IMPORTANT NOTE: It is the responsibility of the end user to ensure that the cable's braided screen is terminated.

Optional Limit Relay hysteresis

Hysteresis is a property of systems (usually physical systems) that do not instantly follow the forces applied to them, but react slowly, or do not return completely to their original state.

To set Relay Limits, refer to the 'Communication Protocol – User Commands' section in this manual.

Hysteresis feature ON

The relay will energise when any channel is one code above the set limit and will only de-energize when all channels are one code below the set limit.

Hysteresis feature OFF

The relay will energise when any channel is one code above the set limit and will only de-energize when all channels are on the set limit.

EXAMPLE ISO SCENARIO

An icountPDZ2 has been set to an optimum flow rate of 60ml/mm and connected to a fluid transfer system. With the icountPDZ2 limit relay switched off (Normally Closed), the limits set to ISO 20/18/13 and the relay cable electrically connected to a Parker Filtration Trolley. The icountPDZ2 will activate the trolley as soon as the set limits are breached. The ten test results below show the effect of having the hysteresis on or off:

	Hysteresis feature ON Filtration Trolley status		Hysteresis feature OFF Filtration Trolley status	
Test 1 result – 20/16/13	OFF		OFF	
Test 2 result – 21/16/13		ON		ON
Test 3 result – 20/16/13		ON	OFF	
Test 4 result – 18/17/14		ON		ON
Test 5 result – 18/16/13		ON	OFF	
Test 6 result – 17/16/11		ON		ON
Test 7 result – 17/16/11	OFF		OFF	
Test 8 result – 18/17/13	OFF		OFF	
Test 9 result – 19/17/14		ON		ON
Test 10 result – 19/17/13		ON	OFF	

ON = Relay activated, OFF = Relay not activated

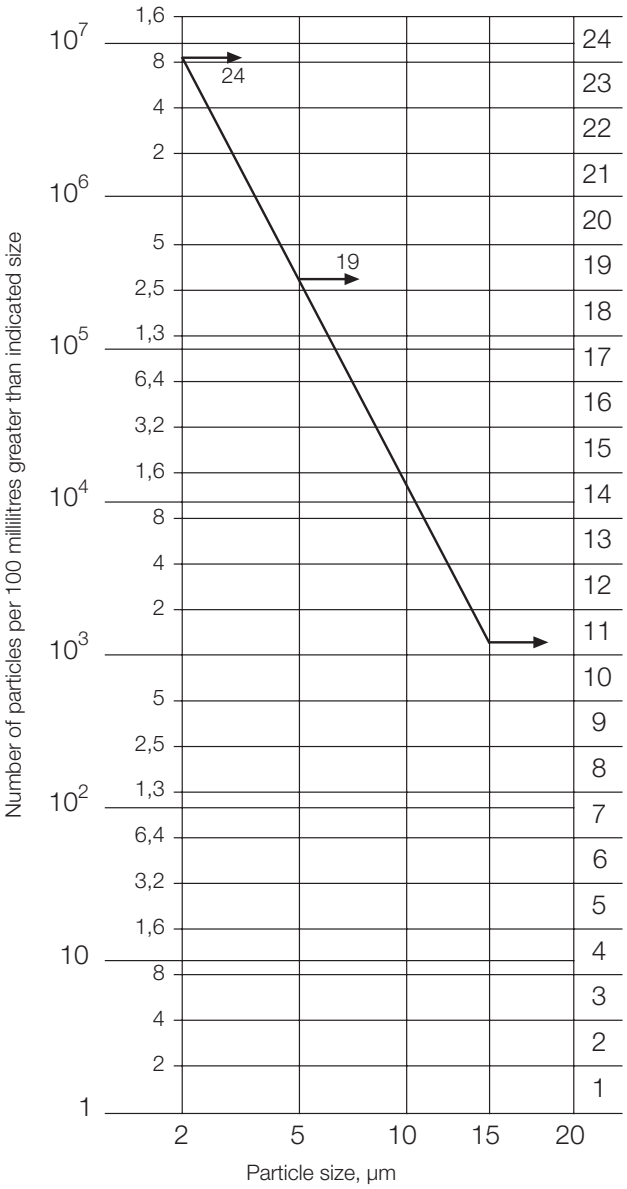
NOTE: Electrical connection to a Filtration Trolley requires the use of a relay

Interpreting data

Solid contaminants in aviation fuel systems vary in size, shape, form and quantity. The most harmful contaminants are normally between 6 microns and 14 microns. The ISO code is the preferred method of reporting quantity of contaminants.

The ISO code number corresponds to contamination levels pertaining to three sizes.

The first scale number represents the number of particles larger than 4µm(c) per 100 millilitre of fluid, the second number for particles larger than 6µm(c) per 100 milllilitre of fluid and the third number for particles larger than 14µm(c) per 100 millilitre of fluid.



Note that interpolation (i.e. estimation within the measured range) is acceptable; extrapolation (i.e. estimation outside of the measured range) is not.

Fuel cleanliness and contamination

Contamination basics

Solid contaminants in fluid systems vary in size, shape and quantity. The most damaging contaminants in fuel systems are normally between 6 and 14 microns (and therefore invisible to the naked eye).

The table below gives an indication of the relative sizes of common objects.

Object	Typical Size
Grain of table salt	100µm
Diameter of human hair	70µm
Limit of human visibility (naked eye)	40µm
Milled flour	25µm
Red blood cells	8µm
Bacteria	2µm

NOTE: One micron (µm) equals one thousandth of a millimetre (1µm = 0.001mm).

The ISO code

The ISO4406 code is the preferred method of reporting quantity of contaminants in a fluid. It is comprised of three numbers i.e. XX / YY / ZZ, where:

- XX is the scale number for particles larger than 4µm(c) per millilitre of fluid
- YY is the scale number for particles larger than 6µm(c) per millilitre of fluid
- ZZ is the scale number for particles larger than 14µm(c) per millilitre of fluid

By definition the three scale numbers will always decrease, i.e. XX > YY > ZZ.

The following table is extracted from ISO4406:1999 and defines the range of particles that each scale number represents.

For example code **20/18/13** indicates that:

- There are between 5,000 and 10,000 particles per millilitre larger than 4µm(c) (i.e. scale number **20**).
- Between 1,300 and 2,500 particles per millilitre larger than 6µm(c) (i.e. scale number **18**).
- Between 40 and 80 particles per millilitre larger than 14µm(c) (i.e. scale number **13**).

Each increment of scale number represents an approximate doubling in the quantity of particles in a fluid. In practical tests, results obtained can flick between one scale number and the next if the actual number of particles counted is close to the crossover point.

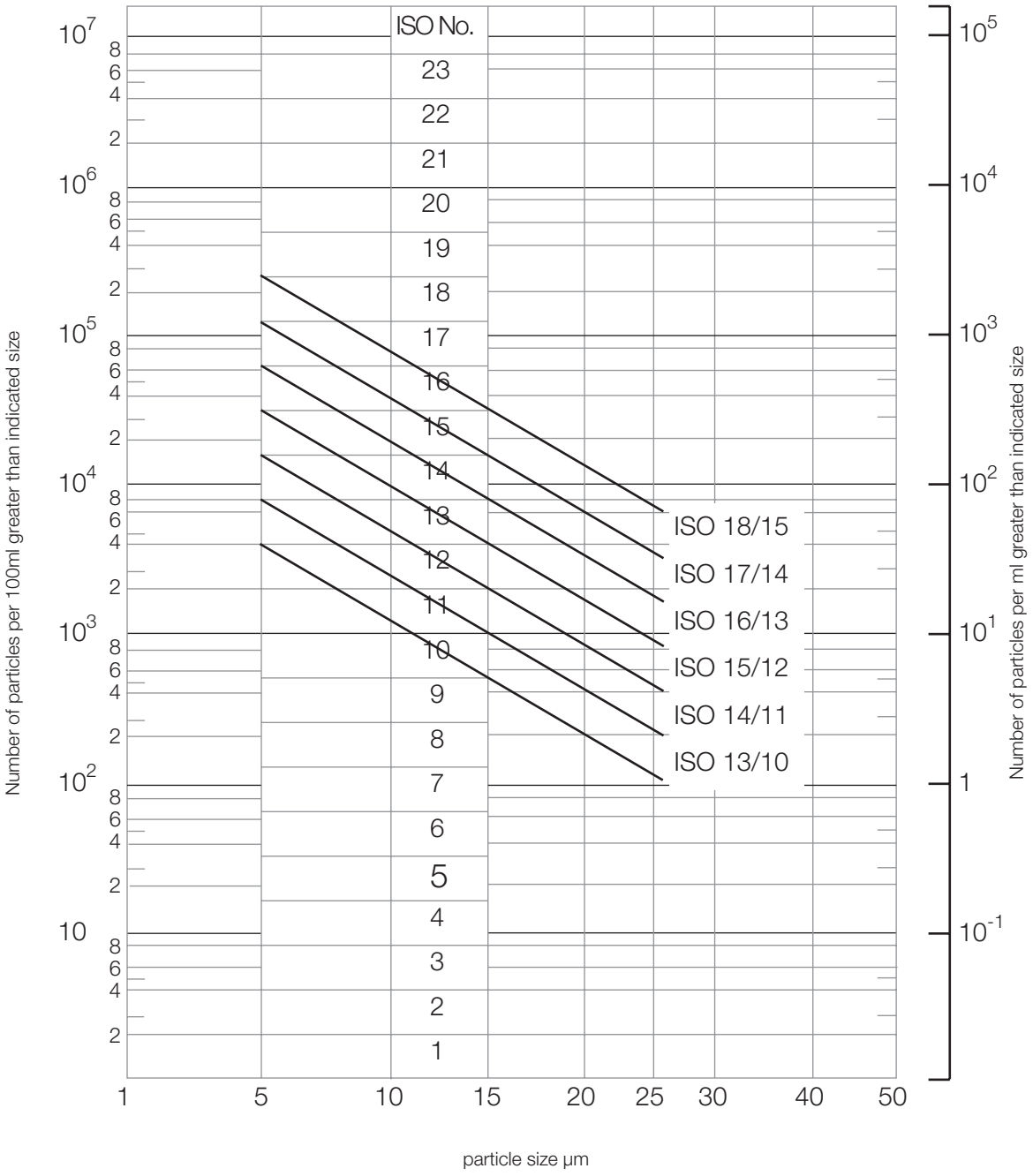
ISO4406 scale number	Number of particles per ml	
	More than	Up to and including
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64
5	0.16	0.32
4	0.08	0.16
3	0.04	0.08
2	0.02	0.04
1	0.01	0.02

When the raw data in one of the size ranges results in a particle count of fewer than 20 particles, the scale number for that size range is labelled with the symbol '>'.

For example, a code of **14/12/>7** signifies that there are more than 80 and up to and including 160 particles equal to or larger then 4µm (c) per ml and more than 20 and up to and including 40 particles equal to or larger than 6µm (c) per ml. The third part of the code, >7 indicates that there are more than 0.64 and up to and including 1.3 particles equal to or larger than 14µm (c) per ml. But the 14µm (c) part of the code could actually be 7, indicating a particle count more than 1.3 particles per ml.

ISO4406 particle distribution chart

The chart includes various ISO level contamination grades



Component cleanliness guidelines

The following table gives suggested acceptable contamination levels for various systems.

Target contamination class to ISO 4406:1999	Sensitivity	Type of system	Typical components
15 / 13 / 09	Super critical	Silt-sensitive control system with very high reliability. Laboratory or aerospace.	High performance servovalves
16 / 14 / 11	Critical	High performance servo and high pressure long life systems, e.g. aircraft, machine tools etc.	Industrial servovalves
18 / 16 / 13	Very important	High quality reliable systems. General machine requirements.	Piston pumps, proportional valves, compensated flow controls
19 / 17 / 14	Important	General machinery and mobile systems. Medium pressure, medium capacity.	Vane pumps, spool valves
20 / 18 / 15	Average	Low pressure heavy industrial systems, or applications where long life is not critical.	Gear pumps, manual and poppet valves, cylinders
22 / 21 / 17	Main protection	Low pressure systems with large clearances.	Ram pumps

ISO contamination charts

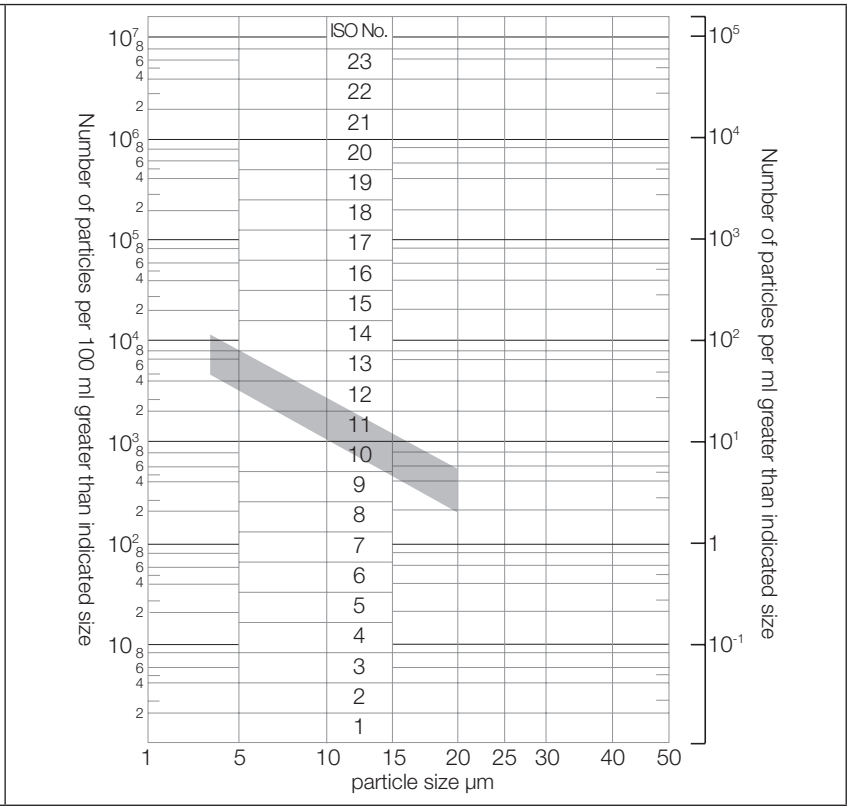
Typical system applications and code numbers

These typical applications and ISO code numbers are taken from the UK Contamination and Control Research Programme (1980–1984).

Ref. AHEM Guide to Contamination Control in Hydraulic Power Systems – 1985

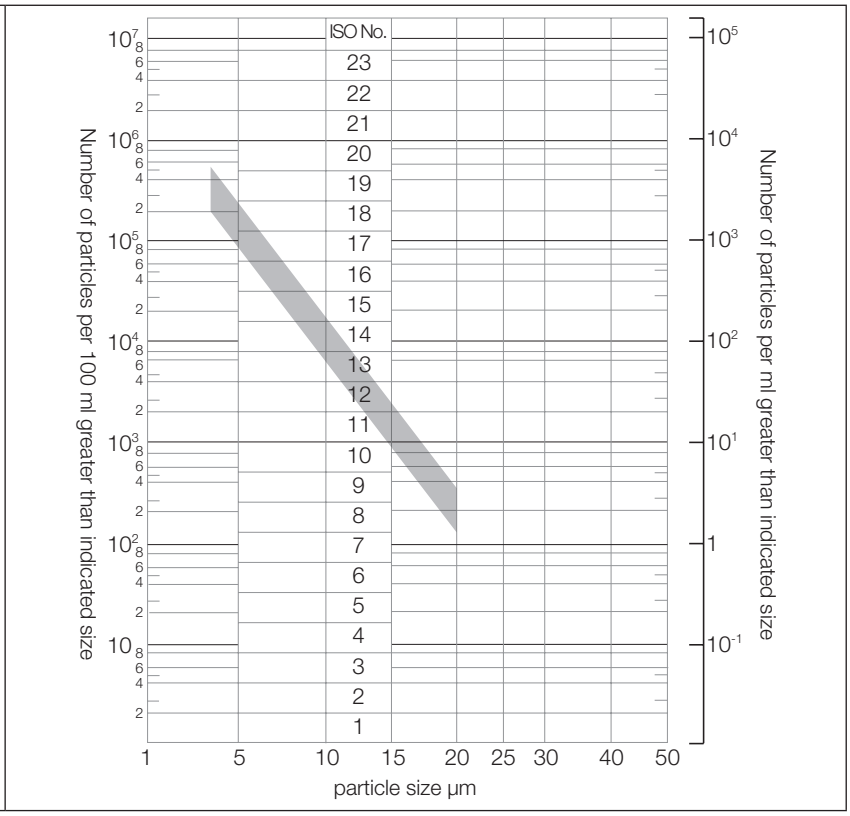
SOLID CONTAMINANT CODE NO 13/10

Application: Aircraft test stands



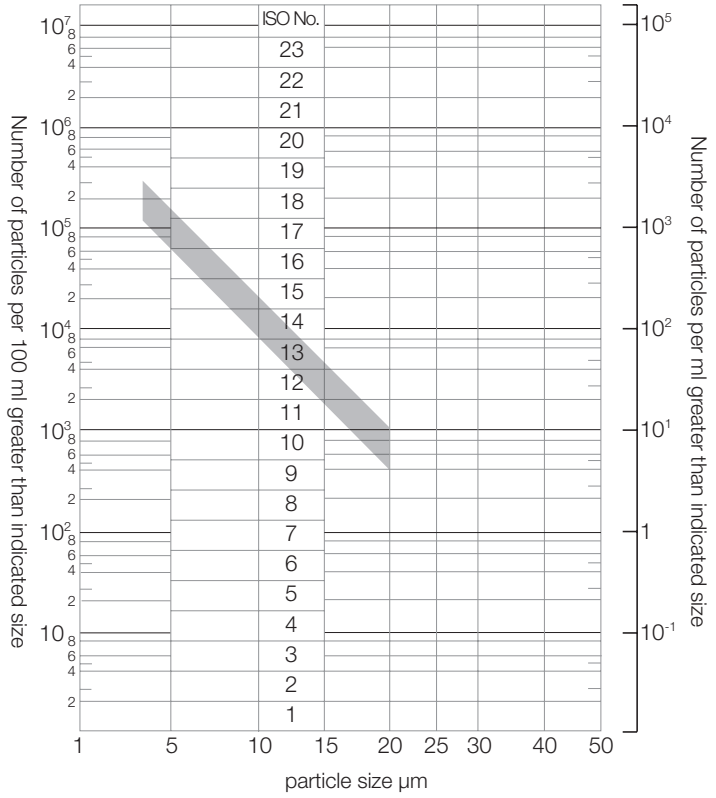
SOLID CONTAMINANT CODE NO 18/11

Application: Mobile systems



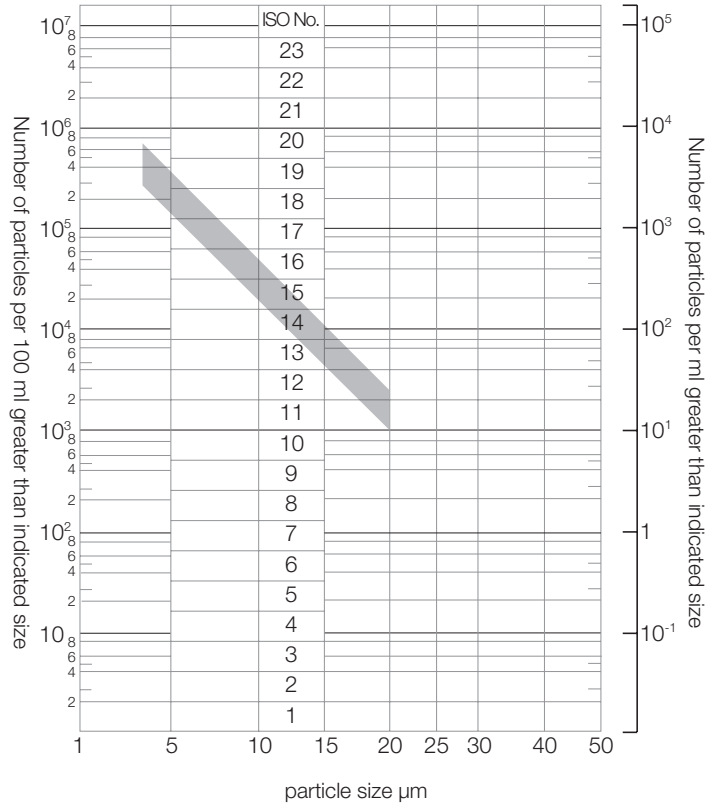
SOLID CONTAMINANT CODE NO 17/12

Application: Marine installations



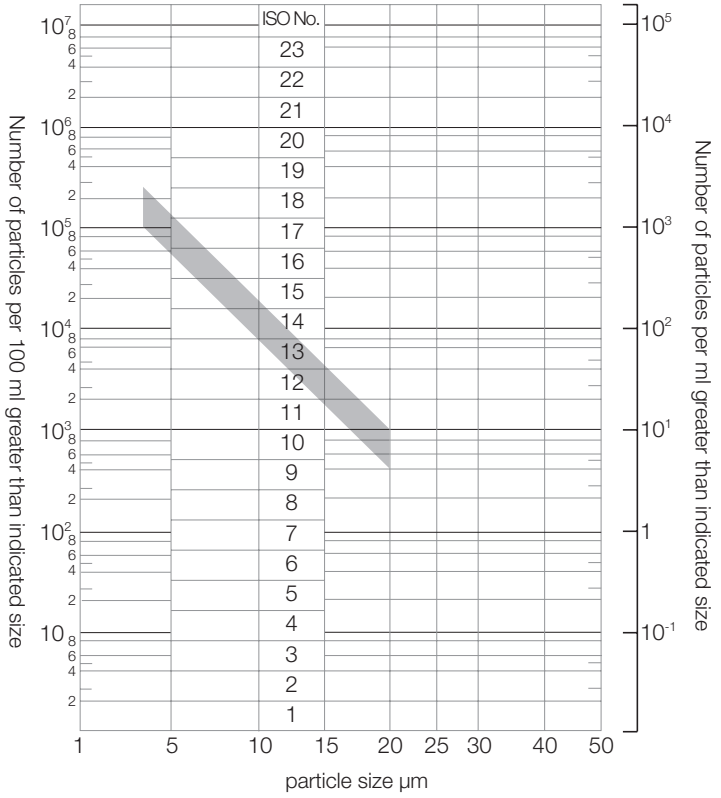
SOLID CONTAMINANT CODE NO 18/13

Applications: Mechanical handling



SOLID CONTAMINANT CODE NO 16/11

Applications: Injection moulding;
Metalworking;
Unused commercial-grade oil



Ordering Information

STANDARD PRODUCTS TABLE

Part Number	Fluid type	Calibration	Display	Limit Relay	Communications	Moisture sensor	Cable connector kit
IPDZ32122130	Fuel	MTD	None	Yes	RS232 / 4–20mA	Yes	M12, 8-pin plug connector
IPDZ32121130	Fuel	MTD	None	Yes	RS232	Yes	M12, 8-pin plug connector
IPDZ32123130	Fuel	MTD	None	Yes	RS232 / 0–5V	Yes	M12, 8-pin plug connector
IPDZ32125130	Fuel	MTD	None	Yes	RS232 / CAN-bus	Yes	M12, 8-pin plug connector

PRODUCT CONFIGURATOR

Key	Fluid type		Calibration		Display		Limit Relay		Comms		Moisture sensor		Cable connector kit	
IPD	1	Mineral	1	ACFTD	**1**	**None**	1	No	**1**	**RS232**	**1**	**No**	00	No
IPDZ	2	Phosphate ester	**2**	**MTD**	2	LED	**2**	**Yes**	**2**	**RS232 / 4–20mA**	2	Yes	10	Deutsch 12-pin DT series connector
IPDR	**3**	**Aviation fuel (4 channels)**	3	AS4059	3	Digital			3	RS232 / 0–5V			**30**	**M12, 8-pin plug connector**
					4	GSM			4	RS232 / RS485				
									5	RS232 / CAN-bus				

IPDZ2 OPTIONS NOT CONFIGURABLE

Key	Fluid type	Calibration	Display		Limit Relay	Comms		Moisture sensor		Cable connector kit	
IPDZ			2	LED		4	RS232 / RS485	2	Yes	00	No
			3	Digital						10	Deutsch 12-pin DT series connector
			4	GSM							

ACCESSORY PART NUMBERS

Description	Part number
Single Point Sampler	SPS2021
Power supply	ACC6NN013
2 x 10 metre M12, 8-pin plug and socket Ultra Lock cable kit	ACC6NN021
RS232 to USB converter	ACC6NN017

Parker Worldwide

AE – UAE, Dubai
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