Content

1 For your safety 4
2 Intended use 4
3 Parts supplied 4
4 Understanding the system 5
5 Installation of a Dräger Polytron Pulsar 7
6 Electrical installation 9
7 Installing and commissioning the Dräger Polytron Pulsar 14
8 Planned maintenance 16
9 Specification 17
10 Receiver default settings 18
11 Certification 19
12 Accessories list 20
13 Fault finding guide 21
14 The Dräger Hand Held Terminal 25
15 The Dräger Polytron Pulsar Digital Interface AI500 29
16 Using the Dräger Polytron Pulsar with HART 32
17 AMS operator screens and help texts 33
18 Declaration of Conformity 44

1 For your safety

1.1 General safety statements

Strictly follow this Technical Manual
Any use of the device requires full understanding and strict observation of this Technical Manual and the Instructions for Use provided with the device. The device is only to be used for the purposes specified herein and in the Instructions for Use.

Maintenance
The device must be inspected and serviced by experts at regular intervals and a record kept. Repair and general overhaul of the device may only be carried out by trained service personnel. We recommend that a service contract be obtained with Dräger for all repairs. Only authentic Dräger spare parts may be used for maintenance.
Observe the chapter “Maintenance“.

Use in areas subject to explosion hazards
Equipment and components which are used in explosion-hazard areas and which have been inspected and approved in accordance with International or European explosion-protection regulations may be used only under the specified conditions. The equipment or components may not be modified in any manner.

WARNING

The Draeger Polytron Pulsar has no user-serviceable parts. Unauthorised opening can lead to a safety related failure of the unit.

1.2 Definitions of alert icons

The following alert icons are used in this document to provide and highlight areas of the associated text that require a greater awareness by the user. A definition of the meaning of each icon is as follows:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in physical injury, or damage to the product or environment. It may also be used to alert against unsafe practices.

NOTICE

Indicates additional information on how to use the product.

2 Intended use

2.1 Dräger Polytron Pulsar open path gas detector

For stationary, continuous monitoring of hydrocarbon gases or vapours that may present an explosion hazard.

2.2 Explosion protection approvals

The explosion-protection approvals are valid for use of the device in gas/vapour-air mixture of combustible gases and vapours under atmospheric conditions. The explosion-protection approvals are not valid for use in oxygen enriched atmospheres. In case of unauthorised opening of the enclosure, the explosion-protection approval is voided.

NOTICE

IThe Dräger Polytron Pulsar is one of the family of detectors certified under the designation GD8.
All certificates will refer to the GD8.

European Certification
ATEX Certificate number SIRA 00ATEX1175
ATEX: II 2 GD
Ex d[ia] IIC T5 (Tamb -40 °C to +60 °C)
Ex d[ia] IIC T6 (Tamb -40 °C to +40 °C)

International Certification
IEC Ex Certificate number IEC Ex SIR 04.0006
IEC Ex:
Ex d[ia] IIC T5 (Tamb = -40 °C to +60 °C)
Ex d[ia] IIC T6 (Tamb = -40 °C to +40 °C)

FM/ANSI
FM ANSI/FM 6325
ANSI/ISA-12.13-04

Tested to IEC 60079-29-4
(conducted by FM Approvals)

DNV Certification
(Cert.-No. A-12526)

3 Parts supplied

1 The Dräger Polytron Pulsar detector comes in two parts a Transmitter and a Receiver. These are supplied ready assembled to their back plates along with their associated Terminal Boxes.
2 An Optical Attenuator for use on beam paths between 4 and 16 metres (this must only be fitted to a 4 to 60m Transmitter).
3 An installation sheet and a quick start guide are supplied with the detector. Installation/operation manuals are also available through local distributors or by contacting Dräger.
4 You will also require a Commissioning Kit which is ordered separately and includes:
   - Dräger Hand Held Terminal
   - 4mm Allen key
   - Test Sheets
   - HHT PC software
   - PC Cable (HHT version)
5 Optional extras that are not required for operation but are recommended include U bolts for pipe mounting and lens cleaning solution (see “Accessories list” on page 20).

4 Understanding the system

4.1 Introduction

The Dräger Polytron Pulsar detects hazardous releases of flammable hydrocarbons with the advantages of the open path technique. The Dräger Polytron Pulsar adds new and unique features which overcome common problems and annoyances in practical installations.
A Transmitter sends a beam of infrared light through the air to a Receiver. A release of hydrocarbon gases anywhere along the beam is detected because they absorb particular infrared wavelengths selectively. Rain or snow in the air and dirt on the lenses do not cause a false indication of gas because they do not share the same characteristic wavelengths. This 'open path' technique can achieve a density of coverage and a speed of response that would otherwise require an extensive array of point detectors. The new features that Dräger Polytron Pulsar adds include the following:

1 The light is produced by pulsed eye-safe sources with a peak power of 30kW. With this high Transmitter power, the Receiver is made immune from sunlight and resonance effects associated with vibration from rotating machinery. Having more than one source ensures that, in the unlikely event of a failure, the system remains functional until the Transmitter can be exchanged.
2 The performance of all open path instruments depends on the accurate aiming of the Transmitter and Receiver towards each other. Often the necessary detection paths require elevated and inaccessible locations. This can make the alignment difficult to do at the time of installation, and difficult to check subsequently when the supporting structures may have moved. Uniquely, Dräger Polytron Pulsar has internal sensors to measure the orientation of the Transmitter with respect to the Receiver, and vice versa. Besides being shown graphically on a Dräger Hand Held Terminal to make installation simple, the directional measurements are available remotely during normal operation, allowing the alignment to be checked. This feature also generates a pre-warning of changes in alignment before they can affect normal operation, and prevents a detector being commissioned before it is correctly aligned.
3 There is a communication path for digital signals from the Receiver to the Transmitter. The Receiver can command the Transmitter to double its power and to increase the flash rate from 1Hz to 4Hz, allowing an eight-fold increase in light flux when visibility is reduced by bad weather or (most importantly) by the mist of condensate often present in real incidents. The higher flash rate is also triggered by the first indication of gas, allowing a validated gas reading to be output in a reduced response time. The link also allows the alignment display for both Transmitter and Receiver to be viewed at both locations, making it easy for one person to install or maintain the system.
4 Open path instruments can suffer interference if a receiver 'sees' another transmitter mounted nearby or in line with the intended one. The Dräger Polytron Pulsar can be switched to separate frequencies analogous to radio channels. Each Receiver locks onto its own Transmitter and ignores light from its neighbours.
5 The Receiver incorporates a data-logger with a non-volatile memory, readable locally or remotely. The data provides a valuable aid for diagnosing practical problems and preventing unnecessary maintenance work. Internally the information is used to monitor slow trends of signal strength and provide a pre-warning signal when the lenses will require cleaning, unaffected by temporary weather conditions.

In addition to these electronic enhancements, Dräger Polytron Pulsar has a mechanical design that provides exceptional stability and ease of adjustment. The head units containing the optical components are mounted in lockable gimbals that allow separate vertical and horizontal adjustments with the other axis clamped. Each axis can be adjusted with a controlled degree of friction provided by PTFE rings then locked solid without disturbing the setting. A cover made of marine grade stainless steel provides mechanical protection and helps minimise the temperature rise of the internal electronics.

4.2 Transmitter

The Transmitter is a three-wire device, with cable terminals for (i) 24Vdc power; (ii) digital communication; and (iii) power and signal common. The connector for the Dräger Hand Held Terminal allows data coming from the Receiver to be viewed at the Transmitter, including the graphical display of orientation and signal strength needed for alignment. The Hand Held Terminal can also configure the Transmitter with its operating channel and a user-entered tag reference. The eye-safe optical output through the (electrically heated) Transmitter lens is mainly infrared, although a controlled amount of deep red light is visible. An Attenuator Plate is fitted over the lens for operating distances below 16m. A central section in the plate is removed for distances between 8 and 16m, retained for distances between 4 and 8m.
There are five operating modes:

1 **Normal Mode.** Flashes of normal intensity are output once a second. The flash rate appears regular to the eye, although it is phase-coded to send directional information to the Receiver. Occasionally a flash will be seen out of the normal sequence as part of an internal self-test cycle.
2 **Strong Mode.** Flashes of increased intensity are output at a regular 4Hz rate.
3 **Alignment Mode.** Flashes of normal intensity are output four times a second. It is easily distinguishable from Strong Mode because there is a noticeable irregularity to the flash rate as it sends directional information to the Receiver.
4 **Low-supply Mode.** Flashes of increased intensity are output at a regular 2Hz rate. This is substituted for Alignment Mode if the Transmitter detects that the supply voltage dips below the specified range when tested with the lens heater on. This test is only carried out during alignment (and hence at the time of commissioning the detector) so that it cannot delay a gas alarm if this coincides with a deteriorating supply.
5 **Fault Mode.** Flashes of maximum intensity are output at a regular 1Hz rate. This is substituted for Normal Mode if the Transmitter has detected that a tube has failed or is intermittent. It is also the way the Transmitter signals to the Receiver that the link between them has been broken. Visually it is not distinguishable from Normal Mode, but is detected by the Receiver to provide warning signals.

4.3 Receiver

The Receiver is a four-wire device, with cable terminals for (i) 24Vdc power; (ii) analogue current loop; (iii) digital communication; and (iv) power and signal common. The analogue output provides fully linearised 4-20 mA gas readings and configurable warning signals. It can be used in both current-source and current-sink circuits. The digital line supplies the signals to switch the Transmitter mode and can optionally be routed to the non-hazardous area to provide two-way digital communications with the AI500 interface. Like the Transmitter, the Receiver has both an electrically heated lens and a port for the Dräger Hand Held Terminal, providing a clear display of present readings and the ability to alter the Dräger Polytron Pulsar configuration, operating channel, and tag reference. For more detail about the facilities offered by the AI500 and the Dräger Hand Held Terminal please see 'Digital Communications' below and the Appendices.
The data logger in the Receiver maintains a non-volatile record for the previous seven days of operation, with consolidated records for the previous 32 weeks. These logs include such essential information as supply voltage, internal temperature, signal strength and Transmitter and Receiver alignment. Dräger software is available which interprets and displays the logged data on a PC running under MS Windows. When used in conjunction with the AI500 interface the software allows a permanent archive of the detailed version to be kept on disk. The disk record will be continuous provided the Receiver log is interrogated at least once per week.

4.4 Digital communications

Dräger Polytron Pulsar's comprehensive digital information can be made available by different routes to suit the level of complexity required. In the simplest installations only the 4-20mA analogue signal is brought to the non-hazardous area. Then a pre-warning condition (such as dirty lenses or misalignment, before they cause a loss of operation) is signalled as a DC level, configurable to be either above or below 4mA. For instance, the Regard Optical Card shows 'WARN' and energises a relay for the default 3.5mA setting. Thus alerted, the user connects the Dräger Hand Held Terminal to the Receiver head. Present readings are displayed on its screen, while past data can be downloaded into the Hand Held Terminal's internal memory and hence transferred to a computer in the non-hazardous area. Similarly, changes to the configuration settings which affect safety can be entered (with password protection) into the Dräger software running on the PC and the resulting configuration file carried to the Dräger Polytron Pulsar in the hazardous area.
A new feature with Dräger Polytron Pulsar allows HART signals to be superimposed on the 4 20mA wire without affecting the normal analogue functions. Installations that include a HART multiplexer in the non-hazardous area provide much of Dräger Polytron Pulsar's digital capability in a way that is compatible with HART-enabled point detectors. Typically the multiplexer is interfaced to a central computer running the Asset Management System (AMS) from Emerson Process Management which communicates with both types of detector interchangeably.
The next simplest category of installation brings the single digital wire from the Receiver into the non-hazardous area, augmenting the basic measurement carried by the 4 20mA loop. The full array of digital information is made available by the AI500 interface, a small unit mounted on a DIN/EN rail with terminals for up to four Dräger Polytron Pulsar's. A separate connector for the Dräger Hand Held Terminal allows a user to 'call up' any of the four Dräger Polytron Pulsar's Receivers, read their measured data, change their configurations, and download their logs; all as if he had gone to the Dräger Polytron Pulsar's themselves. The AI500 also has an infrared data output which enables a standard notebook PC to capture the measured data and logs using the Data Wand DW100. This method is non-contacting and allows the data be taken with no possibility of affecting the safe operation of the system.
Finally, the most comprehensive class of installations has up to 32 AI500 interfaces linked to a PC or other central system via an EIA RS 485 multidrop. Dräger software running on the PC addresses the total system of up to 128 Dräger Polytron Pulsar's, providing full current and historical information and the ability to configure each detector individually.

4.5 Gas calibration and zeroing

Dräger Polytron Pulsar is sensitive to a wide range of gaseous hydrocarbons, including the Alkane series from Methane to Hexane. In contrast to instruments working at 3.4 µm, the difference in response to different Alkanes is relatively small, of the order of ±30%. The Receiver has provision for up to four factory-installed tables providing the calibration and linearisation for specified gases or gas mixtures. The choice of which table is used is configurable by the user. For most applications a Methane table should be selected for mixtures that are predominantly Methane, a Propane table otherwise. There is also a factory-installed option for the Receiver to be optimised for the detection of Ethylene (ethene).
Unlike conventional detectors Dräger Polytron Pulsar's built-in calibrations need no manual adjustment, but a self-zeroing sequence is initiated by the Dräger Hand Held Terminal to complete the commissioning of the detector. The Receiver checks its own and the Transmitter's alignment, and checks and records the signal strength. The zeroing can only be completed if all the checks are passed, and until then a new detector reads full scale and is not useable. The recorded signal strength is used as a reference to detect a loss of signal as the lenses become dirty. For this reason the zeroing should be carried out in clear conditions, at moderate temperature, and without the beam being interrupted. A Dräger Polytron Pulsar should always be re-zeroed whenever it is re-sited, cleaned or re-aligned.
The Calibration Certificate supplied with each Dräger Polytron Pulsar states the lower explosive limit (LEL) [1] or lower flammable limit (LFL) value that was used for each gas. Normally this is to IEC 61779-1 for Dräger Polytron Pulsar's supplied with an ATEX certification, or values published by the American National Institute for Occupational Safety and Health (NIOSH) for those with North American and Canadian certifications. The choice of standard used for the factory calibration can be varied to special order.
Generally, the relatively small differences in the values between the calibration standards is of less consequence for open path instruments than for point detectors, since they do not normally measure gas concentration directly but with a weighting according to the size of a spreading gas cloud. Arising naturally from the way they work, all 'line of sight' detectors measure the total quantity of gas that the beam intercepts. A flammable gas detector reads the concentration in LEL times the length of path that the gas occupies (usually less than the whole Transmitter-Receiver path), making the appropriate units for the measurement LEL metres (LELm).

1 Within this Installation Manual the terms LEL and LFL are inter-changeable and refer to the volume ratio of flammable gas in air below which an explosive atmosphere will not form.

The only exception is when a uniform concentration completely fills a path of defined length, allowing a true measurement of concentration and the appropriate units to be %LEL as for the Duct-Mounted Dräger Polytron Pulsar (see separate manual).
Each of Dräger Polytron Pulsar's linearisation tables covers the range 0 to 8 LELm and this full range of measurement is always available in the digital data stream. The user can configure the span of the 4-20 mA output to any value between 0-4 LELm and 0-8 LELm. Note that a choice other than 0-8LELm does not alter the underlying measurement, but causes readings between the chosen full scale and 8 LELm to be clamped at 20mA.
The installation kit includes plastic test sheets which mimic the infrared absorption of the gases to be detected. They are not used for calibration but provide a convenient check that the detector retains its factory-set calibration and is working correctly. The sheets are marked with their thickness in micrometres (eg 070 = 0.070 mm). The Dräger Polytron Pulsar's Calibration Certificate includes its response to similar sheets at the factory. Note that different sheets, each of an appropriate plastic film, are used for the standard Dräger Polytron Pulsar and for the Ethylene (ethene) optimised version.

5 Installation of a Dräger Polytron Pulsar

5.1 Choosing the path of the beam

1 The siting of an open path gas detector is often not as critical as a point detector, since the released gas only has to find its way into some portion of the beam instead of to a particular point. However siting is still an important consideration. Guidance for siting is contained in EN 60079-29-2.
2 Dräger Polytron Pulsar is immune to sunlight so there is no need to take account of the sun position when siting detectors.
3 The density of the gas to be detected has to be considered. Methane is lighter than air and may be expected to rise, unless released at a low temperature or in a mixture with a heavier gas like Carbon Dioxide. Likewise heavier hydrocarbons may be expected to fall. However such simple considerations as buoyancy may not be a reliable indicator of gas movement in practical situations. Gas leaking from high-pressure systems entrains with it a much larger volume of ambient air, forming a mixture that may be flammable and almost neutrally buoyant. In these circumstances it is the natural air currents or forced ventilation that control the motion of the plume or cloud. Where air movements are unpredictable it may be necessary to use separate beam paths to cover different possibilities.
4 The distance between the Transmitter and Receiver should agree with the model selected (i.e. 4-60m, 30-120m or 100-200m). Note that the Optical Attenuator should be fitted below 16 metres.
5 The beam path and immediate surround should be kept free of obstructions that might hinder the free movement of air in the protected area or block the infrared beam. A clear path of 25cm diameter or greater is recommended. For maximum availability it is also recommended to avoid the following:
   - Smoke stacks, chimneys and exhausts.
   - Steam vents and plumes.
   - Walkways and areas where personnel muster or collect.
   - Splash and spray from moving equipment and cooling towers etc.
   - Parking, loading, cranes, vehicle temporary stops.
   - Vegetation that may grow tall enough to impinge on the path especially with movement by the wind.
   - Surfaces that may obstruct the beam path with a build up of ice or snow.

5.2 Mounting the unit

The Dräger Polytron Pulsar should be mounted to a stable structure free of excessive vibration. Good choices would be a steel bulkhead, brick wall, concrete lamppost or a rigid steel structure. Avoid flimsy metal structures that may flex, or wooden structures that may warp. In open areas a suitable structure close to the ground would consist of a five inch nominal (141mm outside diameter) steel pipe driven 1 metre into firm ground or embedded into a concrete foundation. Tall structures should be suitably guyed or braced.

Figure 1: Dräger Polytron Pulsar pole mounting arrangements

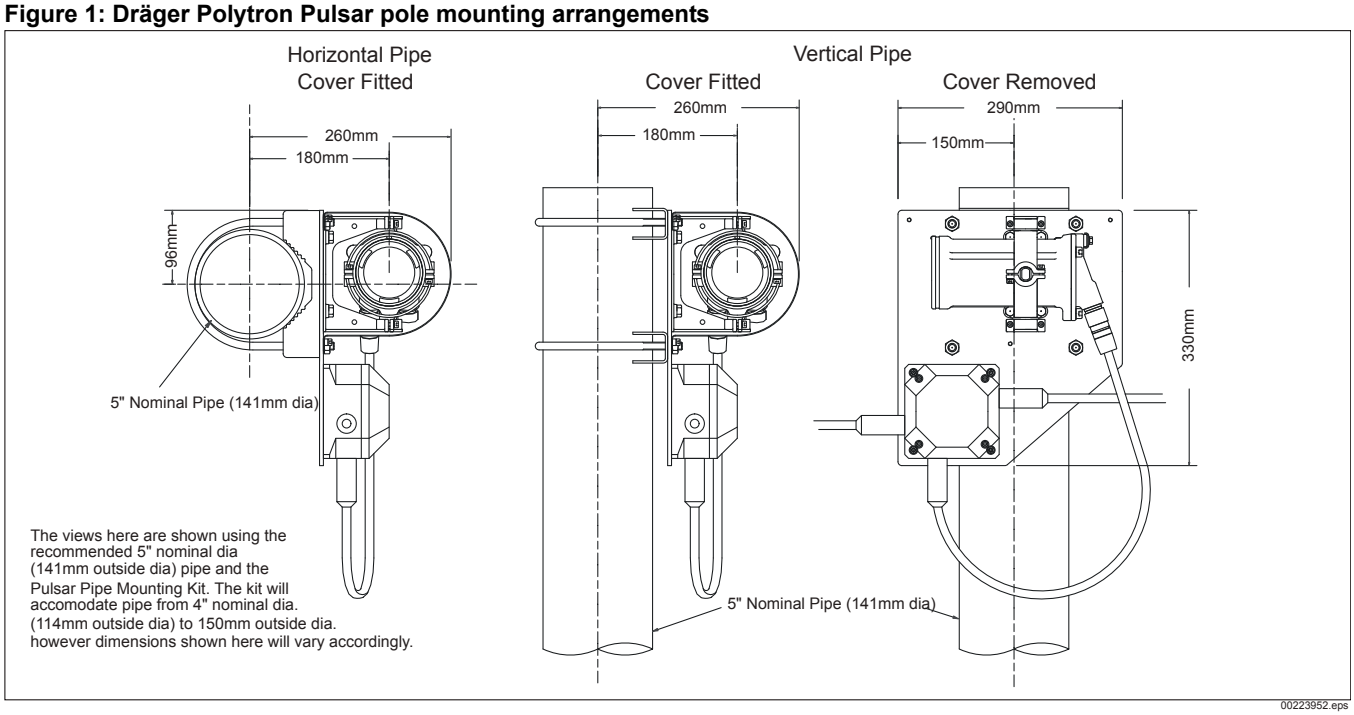
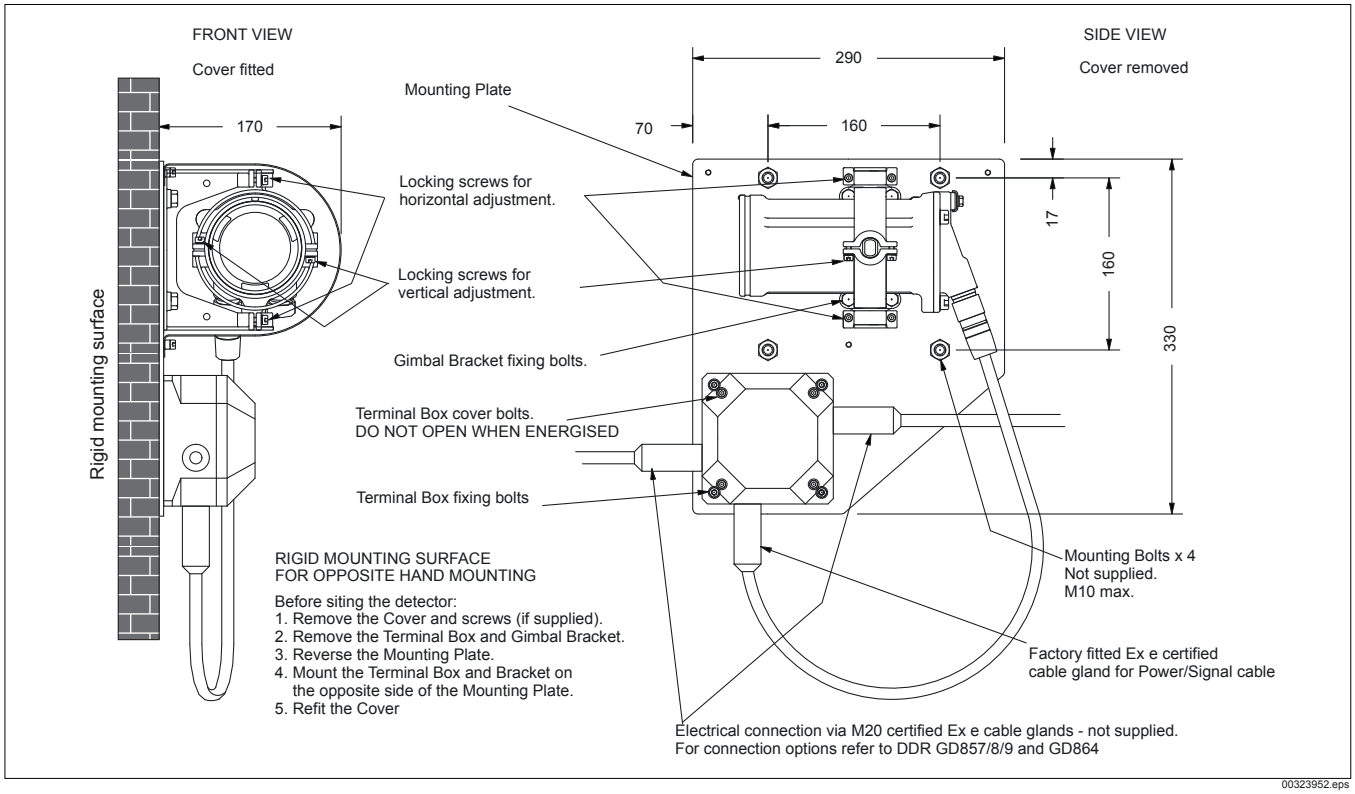


Figure 2: Transmitter/Receiver wall mounting

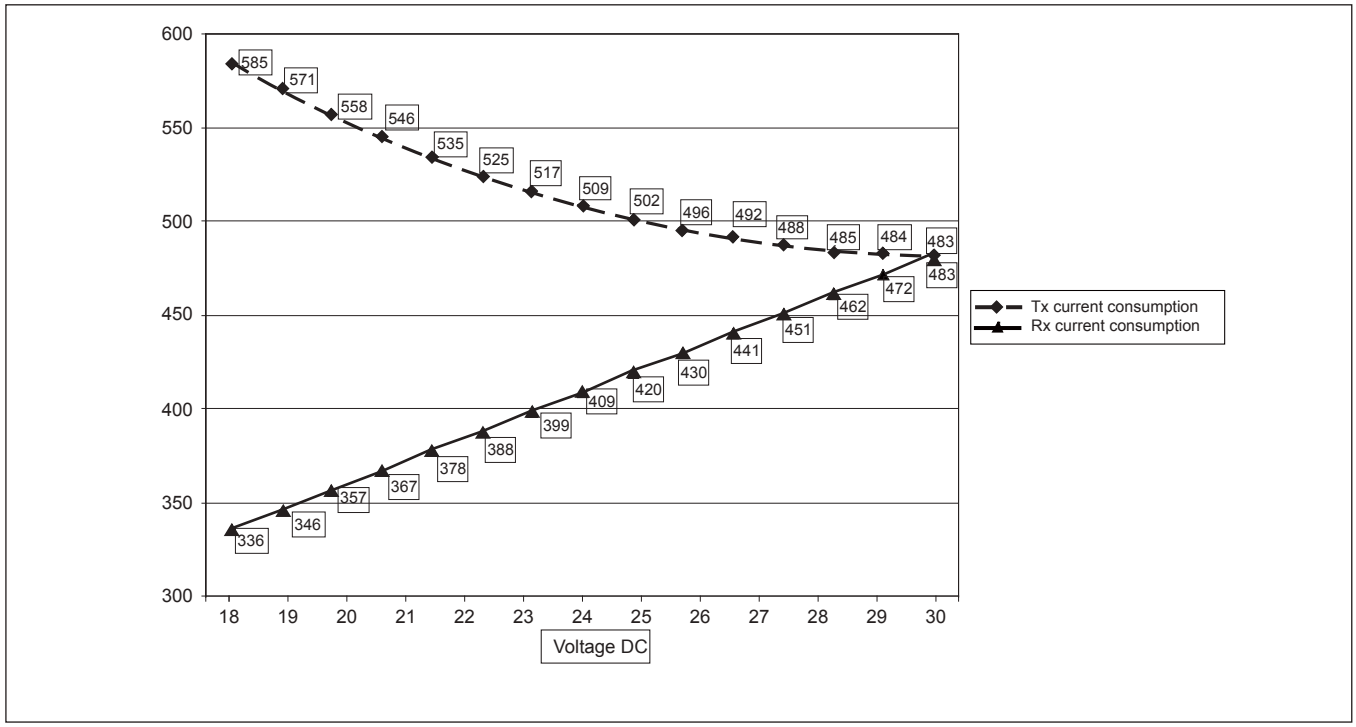


For opposite hand mounting (see figure 1 and 2).

1. Remove front cover annd screws (if supplied).
2. Remove Gimbal Clamps.
3. Reverse the Detector taking care not to kink cable and refit the Gimbal Clamps.
4. Refit the cover.

6 Electrical installation

Field cables specification. -The cables are required to supply between 18 and 30V DC at peak current (all lamps and heaters on). Figure 3 below shows typical values of peak current consumption for Transmitter and Receiver individually.
The field cable runs must comply with local regulations. Please refer to the Tables over for maximum recommended power cable lengths.Figure 3: Peak current consumption



6.1 Dräger Polytron Pulsar maximum permissible power cable lengths

The following tables give the maximum cable lengths for differing worst case power supply voltages and core sizes.
In using this information please note that the worst-case (lowest possible) supply voltage should be used not the nominal stated.
The lengths stated are determined by the power supply cores. If cable size and distance become excessive it may be more economic to install a local power supply. There is no practical limit on the distance for the signal cables, although the 4-20 mA loop resistance is limited to 500 Ω total.

Cable run in metres: To both Transmitter AND Receiver							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V... 30V**
1 mm^2:	74	98	123	147	172	197	221
1.5 mm^2:	111	147	184	221	258	295	332
2.5 mm^2:	184	246	307	369	430	491	553
4 mm^2:	295	393	491	590	688	786	885
18 AWG:	61	81	101	121	142	162	182
17 AWG:	77	102	128	153	179	204	230
16 AWG:	96	129	161	193	225	257	289
15 AWG:	122	162	203	243	284	324	365
14 AWG:	153	205	256	307	358	409	460
13 AWG:	193	258	322	387	451	516	580
12 AWG:	244	325	407	488	569	650	732
11 AWG:	308	410	513	615	718	820	923
10 AWG:	388	517	646	776	905	1034	1164

Cable run in metres: To Transmitter only							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V...30V**
1 mm^2:	114	152	189	227	265	303	341
1.5 mm^2:	170	227	284	341	398	455	511
2.5 mm^2:	284	379	473	568	663	758	852
4 mm^2:	455	606	758	909	1061	1212	1364
18 AWG:	94	125	156	187	218	249	281
17 AWG:	118	157	197	236	275	315	354
16 AWG:	149	198	248	297	347	397	446
15 AWG:	188	250	313	375	438	500	563
14 AWG:	236	315	394	473	552	631	709
13 AWG:	298	398	497	596	696	795	895
12 AWG:	376	501	627	752	877	1003	1128
11 AWG:	474	632	790	948	1106	1265	1423
10 AWG:	598	797	997	1196	1395	1595	1794

Cable run in metres: To Receiver only							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V... 30V**
1 mm^2:	210	280	350	420	490	559	629
1.5 mm^2:	315	420	524	629	734	839	944
2.5 mm^2:	524	699	874	1049	1224	1399	1573
4 mm^2:	839	1119	1399	1678	1958	2238	2517
18 AWG:	173	230	288	345	403	460	518
17 AWG:	218	290	363	435	508	581	653
16 AWG:	275	366	458	549	641	732	824
15 AWG:	346	462	577	692	808	923	1039
14 AWG:	437	582	728	873	1019	1164	1310
13 AWG:	551	734	918	1101	1285	1468	1652
12 AWG:	694	926	1157	1388	1620	1851	2083
11 AWG:	875	1167	1459	1751	2043	2334	2626
10 AWG:	1104	1472	1840	2208	2576	2944	3312

Cable run in feet: To booth Transmitter AND Receiver							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V... 30V**
1 mm^2:	242	322	403	484	564	645	725
1.5 mm^2:	363	484	605	725	846	967	1088
2.5 mm^2:	605	806	1008	1209	1411	1612	1814
4 mm^2:	967	1290	1612	1935	2257	2580	2902
18 AWG:	199	265	332	398	464	531	597
17 AWG:	251	335	418	502	586	669	753
16 AWG:	317	422	528	633	739	844	950
15 AWG:	399	532	665	798	931	1064	1197
14 AWG:	503	671	839	1007	1174	1342	1510
13 AWG:	635	846	1058	1269	1481	1692	1904
12 AWG:	800	1067	1334	1601	1867	2134	2401
11 AWG:	1009	1346	1682	2018	2355	2691	3027
10 AWG:	1273	1697	2121	2545	2969	3393	3818

Cable run in feet: To Transmitter only							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V... 30V**
1 mm^2:	373	497	621	746	870	994	1118
1.5 mm^2:	559	746	932	1118	1305	1491	1678
2.5 mm^2:	932	1243	1553	1864	2175	2485	2796
4 mm^2:	1491	1988	2485	2983	3480	3977	4474
18 AWG:	307	409	511	614	716	818	921
17 AWG:	387	516	645	774	903	1032	1161
16 AWG:	488	651	813	976	1139	1301	1464
15 AWG:	615	820	1026	1231	1436	1641	1846
14 AWG:	776	1035	1293	1552	1810	2069	2328
13 AWG:	978	1305	1631	1957	2283	2609	2935
12 AWG:	1234	1645	2056	2467	2879	3290	3701
11 AWG:	1556	2074	2593	3112	3630	4149	4667
10 AWG:	1962	2616	3270	3924	4578	5231	5885

Cable run in feet: To Receiver only							
Worst case supply:	**20V**	**21V**	**22V**	**23V**	**24V**	**25V**	**26V... 30V**
1 mm^2:	688	918	1147	1377	1606	1835	2065
1.5 mm^2:	1032	1377	1721	2065	2409	2753	3097
2.5 mm^2:	1721	2294	2868	3441	4015	4589	5162
4 mm^2:	2753	3671	4589	5506	6424	7342	8259
18 AWG:	567	755	944	1133	1322	1511	1700
17 AWG:	714	952	1191	1429	1667	1905	2143
16 AWG:	901	1201	1501	1802	2102	2402	2702
15 AWG:	1136	1515	1893	2272	2651	3029	3408
14 AWG:	1432	1910	2387	2865	3342	3820	4297
13 AWG:	1806	2408	3010	3613	4215	4817	5419
12 AWG:	2278	3037	3796	4555	5315	6074	6833
11 AWG:	2872	3830	4787	5744	6702	7659	8616
10 AWG:	3622	4829	6036	7244	8451	9658	10865

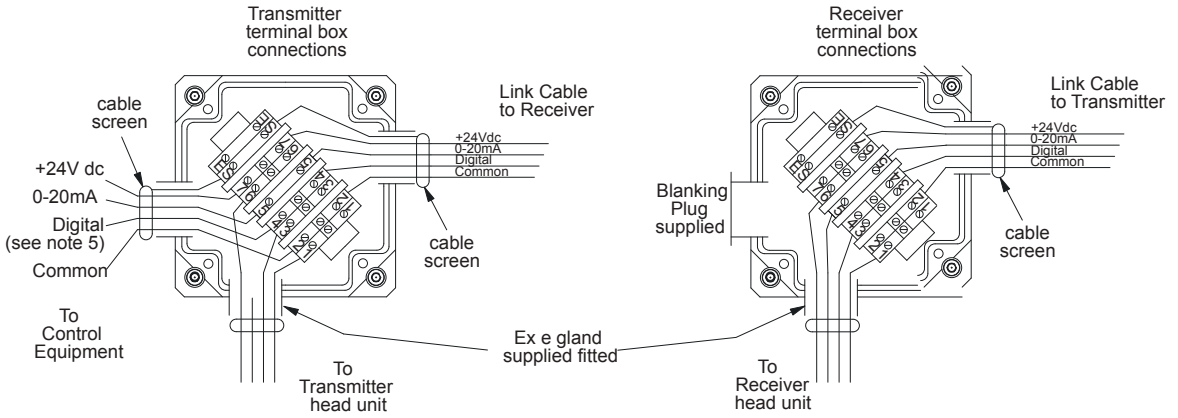
Notes:

1 Ensure that voltage specifications for the Dräger Polytron Pulsar are not exceeded. See “Specifications” section for further information.

2 When the AI500 Digital Interface is used the capacitance of the cable(s) linking it to the Dräger Polytron Pulsar should not exceed 100nF (e.g. 1000m of 100pF/m cable).

3 When several Dräger Polytron Pulsar’s are mounted together at a remote location it may be most economic to mount a local 24VDC power supply in a suitably certified enclosure.

Figure 4: Connection diagram powered via transmitter



NOTES:
1) Glands to be Ex e type e.g. Hawke 501/453/UNIV/...
2) Entry points for Link Cable and Control Equipment may be interchanged provided that the correct connections are maintained.
3) The Transmitter and Receiver assemblies must be securely earthed.
4) It is essential for correct operation that the Digital and Common lines of the Tx and Rx are interconnected even when they are not connected to external equipment.
5) This core may be omitted if the AI500 Digital Interface is not required.
6) does not comply with DNV requirements

CAUTION
This diagram must be followed to ensure correct operation, whether the installation is in a hazardous area or not. For safe operation in a hazardous area you must also refer to the certification documents and comply with all local regulations.

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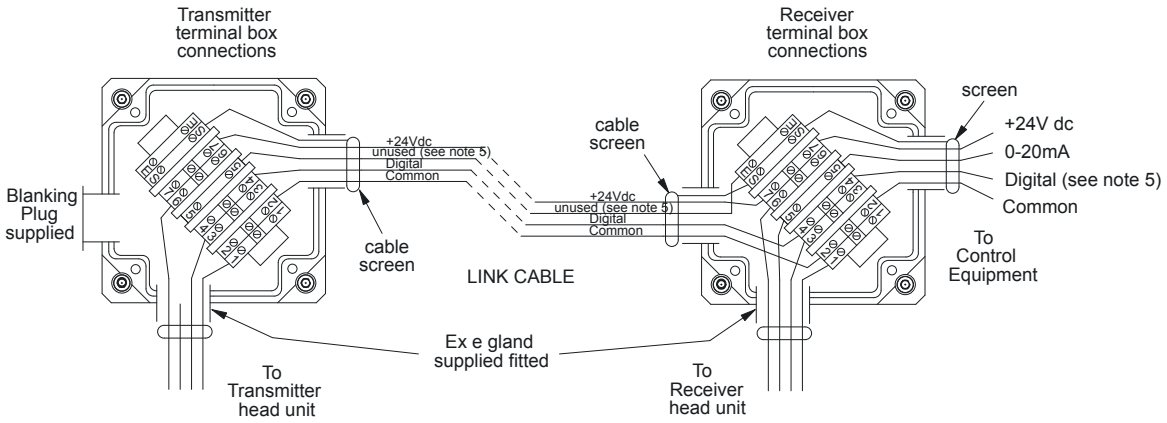
Figure 5: Connection diagram powered via receiver



NOTES:
1) Glands to be Ex e type e.g. Hawke 501/453/UNIV/...
2) Entry points for Link Cable and Control Equipment may be interchanged provided that the correct connections are maintained.
3) The Transmitter and Receiver assemblies must be securely earthed.
4) It is essential for correct operation that the Digital and Common lines of the Tx and Rx are interconnected even when they are not connected to external equipment.
5) This core may be omitted if the AI500 Digital Interface is not required.
6) for DNV compliant installations connect the cable screen one sided to PE on the power supply

CAUTION
This diagram must be followed to ensure correct operation, whether the installation is in a hazardous area or not. For safe operation in a hazardous area you must also refer to the certification documents and comply with all local regulations.

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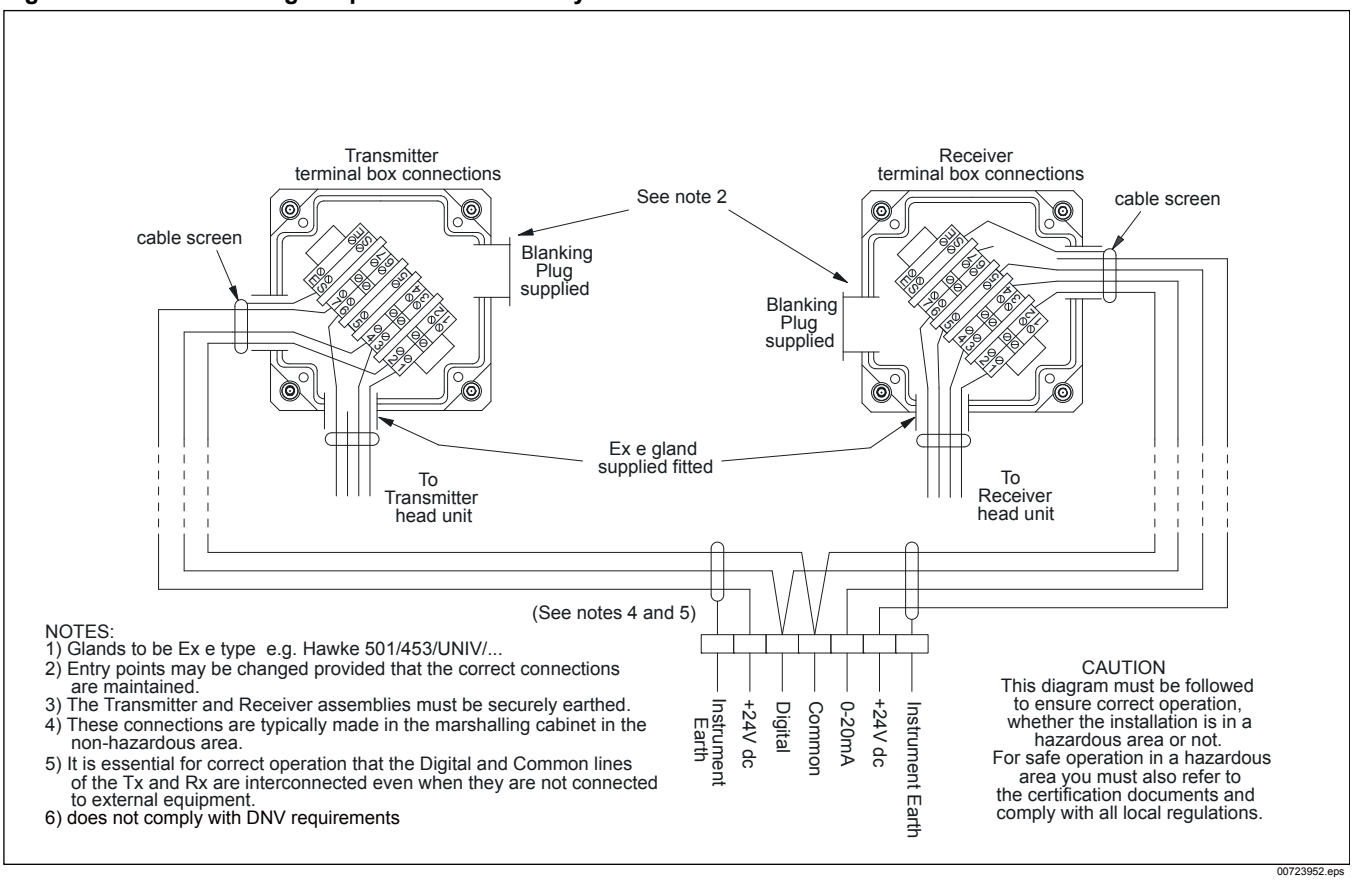
Figure 6: Connection diagram powered individually



7 Installing and commissioning the Dräger Polytron Pulsar

To install the Dräger Polytron Pulsar you require:

- Dräger Polytron Pulsar Transmitter and Receiver.
- Dräger Hand Held Terminal (Part of alignment kit).
- 4mm Allen key (Part of alignment kit)
- Suitable spanner for fixing. (Not supplied)
- Set of plastic Test Sheets. (Part of alignment kit)
- U bolts if fixing to a pipe. (Supplied if ordered as an accessory)
- Nominal 24V dc power.
- Where junction boxes are used Three M20 Ex e certified cable glands if unit is to be powered via Transmitter or via Receiver.
  Two M20 cable glands if unit is to be linked in marshalling/control cabinet. (Not Supplied).
- Attenuator plate if the operating distance is below 16m
- A portable detector to check that the beam path is free of hydrocarbon gas before zeroing.

1. Carefully unpack the equipment and check the contents of the boxes against the packing note. In case of shortages or damage contact the carrier, Dräger or the distributor immediately.
2. Mount the Dräger Polytron Pulsar on a suitable structure, ensuring that the beam path meets the criteria laid down in section “Installing The Dräger Polytron Pulsar”.
3. Connect the field cables (see Electrical installation section) and apply power

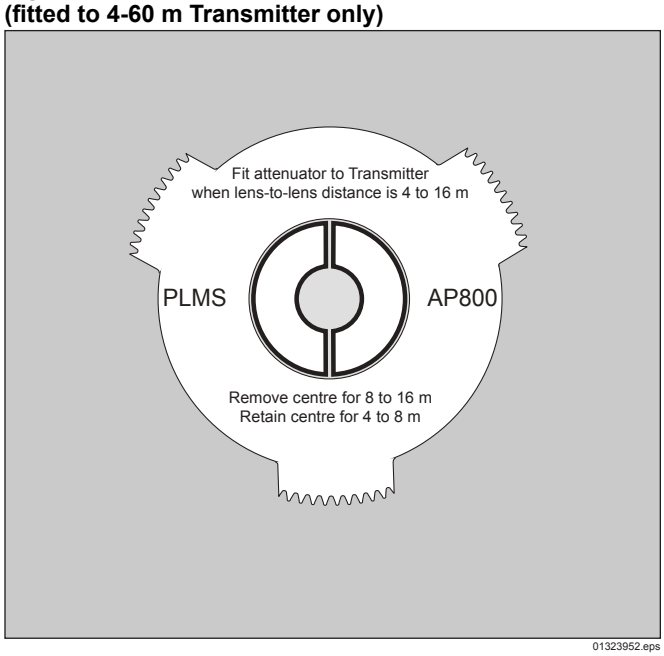
NOTICE

Only apply the power if you intend to fully commission the detector at this stage.

4. If the beam path is less than 16m the AP800 attenuator (see figure 11) must be fitted to the TRANSMITTER. The attenuator has push out sections depending on the distance over which the Dräger Polytron Pulsar is to be used, the inner sections should be removed for beam paths between 8 and 16m. To fit the attenuator press the three serrated tabs firmly into recesses in the transmitter lens retaining ring.

- **During the alignment and zeroing procedure the output from the Dräger Polytron Pulsar will vary between 0 and 20mA. To avoid false alarms, the alarm acitvation at the control device ist to be locked.**
- **The following sections explain how to commission the Dräger Polytron Pulsar, see “The Dräger Hand Held Terminal” section for using the Dräger Hand Held Terminal. Essentially the same steps can be carried out using the MTL611B Dräger Hand Held Terminal (based on a Psion Organiser) that was formerly supplied, or with a laptop computer, running software supplied by Dräger. Please refer to the appropriate documentation.**

Figure 7: AP800 Attenuator plate (fitted to 4-60 m Transmitter only)



7.1 Configuring the transmitter and receiver

Like two-way radios, the Dräger Polytron Pulsar Transmitter and Receiver are switchable between different frequency channels. The Transmitter and Receiver need to be set to the same channel, chosen to be different from the channels in use by neighbouring Transmitters. In this case it is only Transmitters whose light can reach the Receiver, directly or by reflection, that could cause interference.
Transmitters labelled '4 to 60m' are allocated channels 0 to 7 (factory set to 0); '30 to120m' and '100 to 200m' channels 8 to 11 (factory set to 8).
To set the channel at the Transmitter and Receiver select **TAG** in the 'Tx Main Menu' and 'Rx Memory Menu'. At the same time you have the opportunity to enter an alphanumeric tag string up to 11 characters long. Although not required for correct operation of the detector, a meaningful tag that identifies the location of the Dräger Polytron Pulsar is strongly recommended. It becomes part of the data logger records read out in future, allowing their source to be known explicitly rather than by tracing serial numbers. Likewise, the tag is available when several Receivers are connected to an AI500 Digital Interface, and possibly several AI500s connected in a multidrop, allowing any misrouting of the connections to be quickly traced.
Other configurable settings in the Receiver (such as the quantity of gas for full-scale in the 4-20mA current loop) baseline deadband or auto zero tracking - AZT are less frequently changed and are often the same for all Dräger Polytron Pulsar’s at the same site. The current values active in the Receiver can be read by selecting **SETS** in 'Rx Main Menu'. A new configuration file can be written from the Hand Held Terminal with **USER** in 'Rx Memory Menu'. To see the settings that are available to be sent, choose **SETS** in the 'Not Connected' menu. To change them, connect the Dräger Hand Held Terminal to a computer in the non-hazardous area, go to **PC** in the 'Not Connected' menu, and run the Dräger software supplied. AZT automatically cancels small deviations of gas reading that persist for a long time. The rate is set in units of LELm/h. Baseline deadband is the threshold of gas readings that cause the analogue output to rise above either 4mA or the Warning Current. AZT and baseline deadband settings should be chosen while considering the ambient

condition at the point of installation. In particular in harsh outdoor environments where a slow increase of gas is not possible, higher AZT and baseline deadband settings can be chosen. In indoor applications where small leaks could lead to a slow increase of gas concentrations, AZT and baseline deadband values must be kept at a low level. Detail see: Receiver default settings.

NOTICE

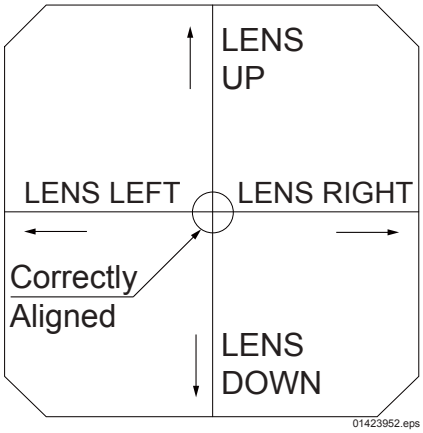
The Dräger Polytron Pulsar is supplied with default configurations as listed in the Specifications section. Any changes to these default settings are carried out as part of the commissioning process.

7.2 Alignment and zeroing

The Dräger Polytron Pulsar must be aligned and zeroed when it is first installed and whenever the Transmitter or Receiver are moved. Before carrying out the electronic alignment with the Dräger Hand Held Terminal, check whether the Attenuator Plate needs to be fitted (see above) and that the units point towards each other as accurately as possible by eye. This will save time by reducing the number of steps needed and ensure that you find the strong central peak. Be aware that weaker, false peaks can occur when the Transmitter and/or Receiver point away from the correct axis, for instance when light from the Transmitter reflects off an adjacent surface.
To access the Transmitter and Receiver gimbals, Remove the cover screws and lift off the cover. Loosen the eight clamping screws on the gimbals assembly, and then retighten them gradually until the head unit will move smoothly in all directions but remain in position.

7.2.1 Step 1. Initial Receiver alignment

Select ALIG in the 'Rx Align + Zero' menu to put the Receiver into its Alignment Mode. Digital signals from the Receiver will in turn command the Transmitter to flash in its Alignment Mode (an irregular flash sequence) and cause the Dräger Hand Held Terminal to show an Alignment screen. The live display shows the received signal strength both numerically and as a bar-graph. Above and to the right is a Cartesian 'target' showing the orientation of the Receiver with respect to the straight line to the Transmitter lens:



First move the Receiver around to be sure you have found the strong central peak in signal. Now make slow adjustments in the vertical and horizontal directions alternately, each time correcting the direction with the greater error, until the display looks like the diagram. Tighten the eight screws progressively in rotation to avoid shifting the alignment.

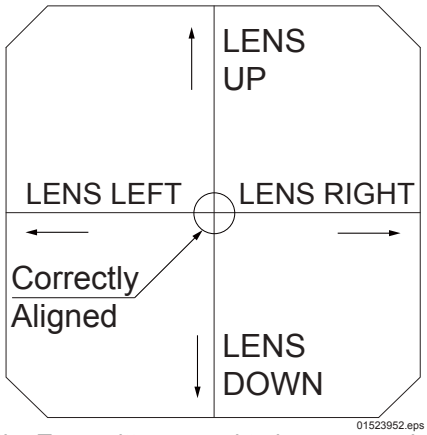
7.2.2 Step 2. Transmitter alignment

NOTICE

The alignment screen on the Dräger Hand Held Terminal will vary depending on whether you are aligning a 4-60m Transmitter or the longer range Transmitters (30-120m and 100-200m). Please ensure you follow the correct step for EITHER a 4-60m Transmitter or 30-120m and 100-200m Transmitters highlighted below.

4 to 60m Transmitter

Connect the Dräger Hand Held Terminal and check that the signals from the Receiver are being displayed. If they were absent it would indicate that the digital link from the Receiver was not connected, usually due to a wiring fault. Also look into the Transmitter lens to check it is flashing at the correct, irregular rate of four per second. A regular twice per second would indicate inadequate voltage at the supply or excessive voltage drop in the supply cables.
At the left of the Alignment screen the Transmitter 'target' shows its orientation with respect to the straight line to the Receiver lens:

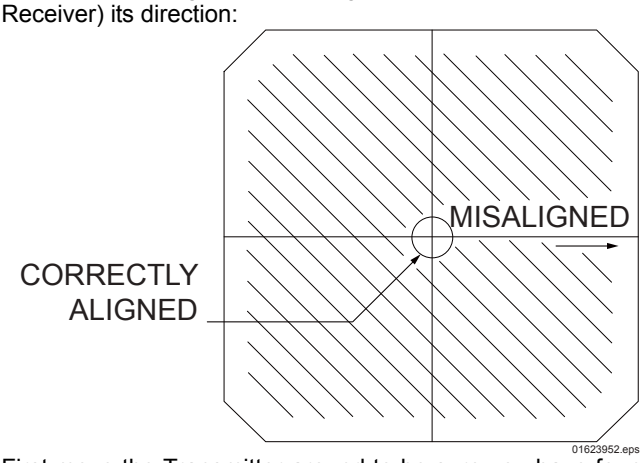


First move the Transmitter around to be sure you have found the strong central peak in signal. Make slow adjustments as before, correcting the horizontal or vertical direction with the greater error, until the display looks like the diagram. Tighten the eight screws progressively in rotation to avoid losing the alignment. The Transmitter and connector covers can now be replaced. Proceed to step 3.

30 to 120m and 100 to 200m Transmitters

Connect the Hand Held Terminal and check that the signals from the Receiver are being displayed. If they were absent it would indicate that the digital link from the Receiver was not connected, usually due to a wiring fault. Also look into the Transmitter lens to check it is flashing at the correct, irregular rate of four per second. A regular twice per second would indicate inadequate voltage at the supply or excessive voltage drop in the supply cables.

At the left of the Alignment screen the Transmitter 'target' indicates the degree of misalignment but not (unlike the Receiver) its direction:



First move the Transmitter around to be sure you have found the strong central peak in signal. Make slow adjustments, first vertically then horizontally, to maximise the signal strength. The final horizontal adjustment moves the circle from right to left, until the display matches the diagram. Tighten the eight screws progressively in rotation to avoid losing the alignment. The Transmitter and connector covers can now be replaced.

7.2.3 Step 3. Final Receiver alignment

As you return to the Receiver use the portable detector to check that the beam path is free of gas, in preparation for the zeroing procedure that follows. At the Receiver, make any final adjustment needed to centre the display. This is more likely to be necessary if the initial alignment was poor, or if the operating distance is short, causing movements of the Transmitter to have a proportionately larger angular effect at the Receiver. Replace the Receiver cover, ensuring all the screws are tight. Leave the Hand Held connected for Step 4.

7.2.4 Step 4. The Zeroing Procedure

The Zeroing Procedure must be carried out whenever the Dräger Polytron Pulsar is cleaned or realigned. It checks the installation and stores measurements for the normal situation that the path is free of gas and has good visibility. These form the standards of comparison to detect dirt on the lenses and gas in the path, so it is essential that the beam is unobstructed by people or objects and there is no fog or gas in the air. For preference choose a time when the weather is dry, the temperature moderate, and the Dräger Polytron Pulsar has been powered for at least 30 minutes.
Select **ZERO** from the 'Rx Align + Zero' menu. There is a countdown from 32 to show the progress of the zeroing and a display of relevant measurements such as the Receiver's (internal) temperature and supply voltage. The countdown proceeds slowly at first, then more rapidly as the Transmitter switches to Strong Mode. It should reach zero in about 40 seconds and then be replaced by a zero gas reading, showing that the procedure is complete. If any of the checks on the installation fail then the countdown will halt or re-start. They are deliberately made more stringent, for instance in the accuracy of alignment required, than the laxer standards that would allow a working Dräger Polytron Pulsar to remain so. You are prompted to press a key to see an explanation of the problem. The countdown visible at the Hand Held is accompanied by a downward ramping of the analogue current loop signal from 20mA. This allows personnel in the non-hazardous area to follow the progress of the zeroing and to check that the analogue circuit is not prevented from reaching full scale.

7.2.5 Step 5. Verification with Test Sheets

The purpose of the Test Sheets is described in Understanding The System. Hold a stack of five immediately in front of the Receiver lens. Verify from the Hand Held screen and from the control equipment that the complete system responds correctly, as if to gas. If the reading is off scale, remove sheets one by one until it is on scale. Record the mean reading, together with the serial numbers of the Transmitter, Receiver and Test Sheets for future reference. Recording the Test Sheet readings enables you to check subsequently that the response to gas has not been affected in any way. You may also wish to introduce the Sheets one by one to check correct operation of the control equipment at intermediate readings. If required, similar checks can be carried out with real gas using the Gas Check Kit GCK400. Unlock the alarm activation at the control device to put the system back to normal operating mode.

8 Planned maintenance

1 The Dräger Polytron Pulsar has been designed so that it will give long and reliable service with the minimum of maintenance. The Dräger Polytron Pulsar will warn the operator if the Optics become contaminated or if it becomes misaligned for any reason.
2 Depending on the application and the environment as well as the work practices at the site planned maintenance consists of-

- Checking the detectors response to Gas Check Cards. Ensuring first that any control functions have been inhibited.
- Cleaning the optics as necessary. If the detector warns of contaminated optics or if it is known that the detector may have been contaminated by drilling mud, oil mist, dust etc. The lenses are specially coated to assist in keeping them clean, however if it becomes necessary to clean them care must be taken so as not to remove the lens coating. A soft cloth with clean fresh water or Dräger lens cleaning fluid should be used. The detector should be realigned and rezeroed as per the instructions following any work on the detector. Unlock the alarm activation at the control device to put the system back to normal operating mode.

9 Specification

Housing	Electro-polished ANSI type 316 marine grade stainless steel
Mounting/brackets	Electro-polished ANSI type 316 marine grade stainless steel
Cover	Polished ANSI type 316 marine grade stainless steel
Lens	Treated optical glass
Integral Cable	Armoured, flame retardant, halogen free, MUD resistant
Operating distance	4 to 60m, 30 to 120m or 100 to 200m Transmitter to Receiver
Operational limit	-40 °C to +60 °C (-40 °C to +140 °F), 800 to 1100 hPa, 0 to 100% r.h.
Span	Configurable between 0 - 4 LELm and 0 - 8 LELm.
Source	Xenon flashlamps with built-in redundancy. First lamp failure causes Receiver to output warning, operation continues with unchanged calibration.
Calibrations	No field calibration required. Receiver holds factory-calibrations for up to four gases or gas mixtures, switchable by field configuration. The LEL/LFL values for calibrations are to IEC 61779 (factory-option of NIOSH or EN 50054). Gases detected include the alkane series methane to hexane. Receiver version optimised for ethylene (ethane) has separate part number see “Accessories list” on page 20. Warm-up time : 12 s. Beam-block period after power interruptions (≥ 10 ms) : 12s.
Response time	**With Rx Tx digital link:** Normallyy ≤ 2.0 seconds to ≥90% following a step change in path-integral concentration. Increases to ≤10s to achieve maximum performance in reduced visibility due to fog etc. **Without Rx Tx digital link:** Normally ≤ 2.5 seconds to ≥90% following a step change in path-integral concentration. **(NOTE: Operation without link is not recommended for locations liable to reduced visibility due to fog, snow, dust storms etc.)**
Interference	Immune to common contaminants and sun and flare radiation.
Alignment	Built in sensor system with separate “radar” displays on Handheld screen for Transmitter and Receiver alignment. Zeroing not possible unless correctly aligned (≤ ± 0.15°). Tolerance ± 0.6° before Beam-block.
Mounting	Dual clamping gimbals assembly.
Firmware	Upgradeable by portable PC connected to local Hand Held port or remote AI500 interface.
Outputs	Fully linearised 4-20 mA gas signal with Fault at 0 mA, Beam-block at 2 mA, and a configurable Pre-warning for dirty or misaligned optics, broken Rx-Tx link, or first lamp failure (0 to 5 mA, default 3.5 mA). LEL.m = ((I (in mA)-4 mA)/ 16 mA * (full scale)). Overrange at 20.5 mA. Output is self-configuring for current-source and current-sink circuits. Interrogation/diagnostics of the detector, locally via the handheld device, or remotely via 4^{th}-wire digital link to AI500.
Connections	**Transmitter:** three wire (3rd wire optional for Rx-Tx digital link). **Receiver:** four wire (4th wire optional for digital communications and Rx-Tx link).
Power Supply	**Voltage:** 18 - 30VDC (24VDC nominal) See Note on Page 3.
Power Consumption	Rx max: 5 W Tx max: 13W **Current:** ≤ 0.95 A typical @ 24 volts DC , inrush current: 1.5A, see “Electrical installation” on page 9 Figure 3.
Temperature	-40 to 60 °C operating, with integral sun cover. Flare radiation ≤ 2kW/m^2 at ≥30^o to optical axis continuously; ≤ 3kW/m^2 at ≥30° to optical axis for ≤ 20 minutes)
Storage	Temperature: - 40 °C ...60 °C/ -40 °F ...140 °F Humidity: 0...95% r.H. Pressure: 700...1300 hPa.
Repeatability	± 0.1 LFLm
Linearity Error	± 5 % of Full Scale Deflection
Optics	Integral heater to eliminate snow/icing.
Data-logger	Integral with non-volatile memory. Records events and max-min operating parameters with 2 hr resolution, overwritten after 8 days. Consolidated weekly records for 32 weeks. Both records readable locally via Dräger Hand Held Terminal or remotely via AI500 interface to Hand Held or portable PC.
Dimensions	350 x 300 x 170mm
Weight	Transmitter 12kg Receiver 12kg

10 Receiver default settings

Configuration	Range	Default setting standard receiver
Beam Block delay	10 - 255 seconds	60 seconds
Beam block to fault	0 - 255 minutes	60 minutes
Gas calibration (Standard Dräger Polytron Pulsar)	Table 1= Methane Table 2 = Propane Table 3 = Vacant Table 4 = Vacant	Table 1 Methane
Gas calibration (Ethylene Pulsar)	Table 1 = Ethylene Tables 2, 3, 4 = Vacant	Table 1 Ethylene
4-20mA span	4 - 8 LFLm for 20mA	8 LFLm
Auto Zero Tracking rate	0 - 12 LFLm per hour	0.05 LFLm per hour[1]
Dead-Band	0 - 0.5 LFLm	0.3 LFLm[1]
Static pre-warning current	0 - 5mA	3.5mA
Beam block time out to Fault	On/off	On
Static pre-warning	On/off	On
Auto Zero Tracking	On/off	On

1 Default values or lower comply with EN 60079-29-4:2009
Note: Default settings on older Pulsars. This should be taken into account when replacing older units in harsh environments.

11 Certification

Dräger Polytron Pulsar Transmitter and Receive

NOTICE

The Dräger Polytron Pulsar is one of the family of Detectors certified under the designation GD8. All certificates will refer to the GD8.

International Certification
ECEx certificate number IECEx SIR 04.0006
Ex d[ia] IIC T5 (Tamb = -40 °C to +60 °C)
Ex d[ia] IIC T6 (Tamb = -40 °C to +40 °C)

European Certification
II 2GD
Ex d[ia] IIC T5 (Tamb -40 to +60 °C)
Ex d[ia] IIC T6 (Tamb -40 to +40 °C)

FM/ANSI
FM ANSI/FM 6325
ANSI/ISA-12.13-04

Tested to IEC 60079-29-4
(conducted by FM Approvals)

DNV Certification
(Cert.-No. A-12526)

Ingress Protection
(with weatherproof seal)
IP66/67

Electromagnetic Compatibility
EN50270
FCC Part 15 Class A

Terminal Box
Increased Safety Type
OTB-122
ATEX Certificate number Baseefa07ATEX0142X

Ex td A21 T6 T85 °C
IECEx Certificate number IECEx BAS 07.0043X

Material-	Glass filled polyester, flame retardant to IEC92.1, UL94V0
Ingress protection-	IP66
Anti static-	$<10^9$ Ohm
Impact resistant-	2 x 7 Nm

12 Accessories list

Part number	Dräger Polytron Pulsar Accessories
2350297	Sun Shield (stainless steel)
2350298	Junction Box Dräger Polytron Pulsar ATEX (Ex e)
2350299	Mounting Plate Dräger Polytron Pulsar
2350302	Set of 4 U Bolt pipe fixings for 150mm diameter pipe (standard Dräger Polytron Pulsar)
2350306	AI500 Digital interface unit for Dräger Polytron Pulsar
2350325	Dräger Polytron Pulsar Alignment Kit, ATEX/CSA
2350326	Adapter AI500 to HHT or PC
2350327	Dräger Polytron Pulsar PC Software with cable (supports Dräger Polytron Pulsar, AI500 and HHT)
2350238	Data wand for AI500
2350339	Attenuator plate AP800
2350322	Dräger Polytron Pulsar Remote Junction Box/HHT Kit
2350405	Set of 6 U Bolt fixings (CSA & UL Dräger Polytron Pulsar)
2350451	Gas test sheets (Dräger Polytron Pulsar Duct Mount)
2350505	Dräger Polytron Pulsar Alignment Telescope
2350519	Dräger Polytron Pulsar Alignment Kit, ATEX/CSA (Ethylene Dräger Polytron Pulsar only)
2350520	Gas test sheets (Ethylene)
2350521	Gas test sheets (set of 5, spares for p/n 2350325)
4208729	Desert Modification Kit

Part number	Dräger Polytron Pulsar
2350292	Dräger Polytron Pulsar ATEX 4-60m (Complete TX + RX)
2350294	Dräger Polytron Pulsar ATEX 30-120m (Complete TX + RX)
2350304	Dräger Polytron Pulsar Demonstration unit (c/w HHT, tripods, cables, controller)
2350308	Dräger Polytron Pulsar ATEX 100-200m (Complete TX + RX)
2350309	Dräger Polytron Pulsar ATEX 4-60m (TX only)
2350310	Dräger Polytron Pulsar ATEX 30-120m (TX only)
2350311	Dräger Polytron Pulsar ATEX 100-200m (TX only)
2350312	Dräger Polytron Pulsar ATEX 4-120m (RX only)
2350313	Dräger Polytron Pulsar ATEX 100-200m (RX only)
2350393	Dräger Polytron Pulsar ATEX 4-120m (RX only Ethylene)
2350394	Dräger Polytron Pulsar ATEX 100-200m (RX only Ethylene)
2350419	Dräger Polytron Pulsar ATEX Duct Mount

13 Fault finding guide

NOTICE

The Dräger Polytron Pulsar generates a 4-20 mA signal directly proportional to the measured gas concentration. For monitoring of potentially flammable gas concentrations, the device should be connected to an auxiliary system with latching alarms at adequately chosen signal levels.

13.1 The analogue current loop

In most installations the first indication of detector condition is the analogue current loop reading. To interpret it fully you need to know what digital configuration has been loaded into the Receiver. Be sure to distinguish clearly between these four conditions:

The 4-20mA measurement range
Readings in this range indicate gas on a linearised scale between zero and a full scale quantity of a particular gas. That span and the choice of gas are part of the Receiver configuration. Typically the 20mA reading corresponds to 5 or 8 LEL.m of methane or of propane.

The Pre-warning level
This current is output to warn of conditions that could, eventually, cause an inability to detect gas: misalignments of the Transmitter or Receiver, dirty lenses, or mistriggering of a flash tube. Note that the detector retains its full sensitivity and that any gas reading above a low, configurable threshold overrides the warning. Normally the level is 3.5mA and the threshold is 0.3 LELm. However, some control equipment cannot resolve currents below 4.0mA so 4.5mA, for instance, may be chosen. There is no ambiguity provided the current chosen corresponds to a gas reading below the threshold.

The Beam-block level
An output of 2mA shows that the detector is not able to detect gas for reasons other than a hardware fault at the Receiver. They include fog or a solid obstruction in the beam path, or that the Receiver has become misaligned by two to three times the amount that initiates the Pre warning. For compatibility with other Dräger equipment the 2mA current is fixed, but two time intervals associated with it are configurable. The first is the time an obstruction must stay in the beam path to cause a Beam-block, normally 60 seconds. The second is the time a Beam-block must persist to generate a Fault, normally 60 minutes. In installations where beam interruptions are frequent and tolerable it may be this delayed event which prompts action rather than the Beam-block itself.
A sudden release of a large amount of pressurised and/or refrigerated gas can result in a loss of visibility caused by condensation of atmospheric water or the released gas itself. As true for all optical open path systems, this may induce a beam block on the Dräger Polytron Pulsar which will impair Dräger Polytron Pulsar's ability to detect the gas. The beam block warning would be activated and reported to the user. Although the scenario is rather unlikely, choosing shorter rather than longer path lengths when installing Dräger Polytron Pulsar's in this application can further reduce occurrence. In environments where fog generated by gas leaks is a frequent problem, beam blocks should be taken as indication for potential hazards and the use of additional point detectors should be considered.

The Fault level
An output below 1mA indicates that the detector requires attention, either because of a persisting Beam-block (see above) or a hardware fault. There may be a fault either in the Receiver itself or in the cables and terminations supplying it. Note that a fault which prevents the Transmitter working at all is not distinguishable from an obstruction in the path, so it will generate Beam-block rather than Fault. Note too that the fault-tolerant design of the Transmitter ensures that a partial malfunction will not stop the detector working correctly. However it does generate the Pre-warning (see above) and inhibit alignment and re-zeroing.
Be aware that spurious 'faults' may be caused if the Dräger Polytron Pulsar is used with control equipment from other manufacturers without sufficient attention to detail. Analogue loops are inherently prone to small drifts. Thus a system programmed to recognise any current outside 4 to 20mA as Fault will do so if a zero gas reading drifts to 3.99mA. Likewise, tolerance bands of say ±0.25mA should be allowed for the Pre warning and Beam-block signals.

13.2 Fault finding

Once an abnormal condition has been identified from the analogue loop signal, it is most easily investigated by looking at the digital signals. The Dräger Hand Held Terminal (HHT) can be connected at the Receiver both to view the data stream and to interrogate the Receiver configuration. At the Transmitter the data stream and the Transmitter's (less extensive) configuration are available. If the AI500 Digital Interface is installed then its Communicator port in the safe area is directly equivalent to the HHT connection at the Receiver. For more comprehensive diagnostic purposes the AI500 also allows the long-term records from the Dräger Polytron Pulsar's internal data logger to be downloaded into a portable computer via the infrared Data Wand.
Besides measured values and flags, notice that the HHT shows when new data is received with a block in the top right corner of the Flags display. This useful indicator pulses every few flashes normally, but only a few times a minute if the Receiver is not registering light from the Transmitter.
Voltage and current are measured most conveniently at the terminations of the field cables in the safe area. Be aware, however, that voltage measurements here will not take account of the volt drops in the field cables. Direct electrical measurements at the Transmitter and Receiver terminals will not normally be possible without a safety ('hot-work') permit. Such measurements can be misleading, however, since the current consumption varies continuously with the internal heater and Transmitter charging cycles.

13.3 Problems relating to the Transmitter

Symptoms	Cause	Action
The detector outputs Beam-block. The HHT receives data only a few times a minute. The Transmitter is not flashing	The Transmitter is not powered	Check power supply and cabling
	The Transmitter has an internal fault	Remove the Transmitter head and gimbal assembly from its mounting, replace it with a spare configured to the same Channel, and return it to the factory. Changing the Transmitter will not affect the calibration of the detector, but it must be realigned and re-zeroed in the normal way
The detector outputs Beam-block. The HHT receives data only a few times a minute. The Transmitter is flashing and there is no obstruction in the path but the Receiver is blind to the flashes	The Transmitter and Receiver are configured to different Channels	Reconfigure the Transmitter and/or the Receiver so that their Channels are the same
The detector output is at Pre warning. The HHT indicates a Transmitter Fault	The Transmitter is in Fault Mode because an internal test has indicated that one or more of the flash tubes failed to trigger. The test is made more stringent than normal operation by attempting to trigger the tube at a reduced voltage. A complete cycle of tests is completed a few times per hour if the flash rate is once per second	It is not essential to replace the Transmitter urgently, because the detector remains operational and its performance is not significantly impaired. The Pre warning may clear of its own accord. If it persists then the Transmitter should be replaced at the next convenient opportunity. Remove the Transmitter head and gimbal assembly from its mounting, replace it with a spare configured to the same Channel, and return it to the factory. Changing the Transmitter will not affect the calibration of the detector, but it must be realigned and re-zeroed in the normal way
When the detector is switched to Alignment Mode the Transmitter flash rate fails to change to four per second, but remains at once per second	The link is not connected between the Receiver and the Transmitter	Connect the HHT to the Transmitter. The cause is confirmed if the HHT receives no data. Check the cabling and connections
	The Transmitter is in Fault Mode which prevents the detector being aligned and zeroed. Fault Mode is designed to allow the detector to continue working until it is convenient to gain access to it. However it is not recommended to reinstall a Transmitter already in Fault Mode	Confirm that the HHT indicates Transmitter Fault. Further action as shown above for this Pre warning
When the detector is switched to Alignment Mode the Transmitter flash rate fails to change to four per second, but instead changes to two per second. The HHT does not show any alignment data	An internal test in the Transmitter has detected that the supply voltage is too low. The test is more stringent than an external voltmeter test because it is made with the heater switched on and at the peak of the charging cycle	Check the supply voltage at its source and that the cable run does not exceed the maximum specified for the core size used
We have installed several detectors at similar distances. One shows a lower signal strength than the others. Its alignment readings also seem to wander	A difference of six on the HHT's signal strength scale (in dB units) corresponds to a halving of the signal strength. Variations of a few dB between units are normal. Larger variations could indicate that a Transmitter or Receiver has been aligned onto a false peak. For instance, the Receiver may see the Transmitter both directly and as a reflection in a shiny surface close to the beam path	Realign and rezero the detector, taking care to find the strong central peak. In some circumstances a strong reflection could cause false misalignment warnings and need to be screened or covered

	The mountings of the Transmitter and/or Receiver are not sufficiently rigid	Provide additional bracing for the mountings. Notice that their rigidity is more important than their strength, changes in direction more important than translational movements

13.4 Problems relating to the Receiver

Symptoms	Cause	Action
The detector output is at Fault (<1mA). The HHT receives no data	The Receiver is not powered	Check the power supply and cabling
	The Receiver has an internal fault	Remove the Receiver head and gimbal assembly from its mounting, replace it with a spare with the same configuration, and return it to the factory. Realign and re-zero the detector in the normal way
The detector output is at full scale (20mA)	The self-zeroing sequence has not been completed	Align and zero the detector in the normal way
The detector fails to complete the self-zeroing sequence. The HHT shows the Optics flag is set.	An internal check has detected abnormally high signal strength. This is normally due to the Attenuator Plate not being fitted	Measure the distance between the Transmitter and the Receiver. The Attenuator Plate must be fitted if the distance is below 16 metres. The central cut-out must be removed if the distance is between 8 and 16 metres
The detector fails to complete the self-zeroing sequence. The HHT shows flags indicating Transmitter and/or Receiver misalignment, even though no flags were set in normal operation	The tests for correct alignment are made more stringent during the self-zeroing procedure. This is to give the detector the best chance of working reliably, allowing for small movements in the supporting structure over a period of time	Check that both the Transmitter and Receiver are rigidly mounted. Carefully repeat the alignment procedure, ensuring that both the Transmitter and Receiver are aligned at the centre of the strong central peak. Restart the self-zeroing procedure
The detector output is at Pre warning. The HHT shows the Optics flag is set	The signal strength has remained for some time significantly below the signal recorded when the detector was last zeroed. The margin of signal loss, and the interval for which it must be maintained, to generate the warning are both part of the Receiver configuration. Typical values are 40% loss for more than four days	Check the lenses of Transmitter and Receiver are clean. If necessary, clean, realign and rezero the detector. In some locations fog may persist for longer than the chosen interval, causing the warning to be generated. It may then be ignored, or a longer interval entered
The detector behaves erratically. It changes unpredictably from normal operation with the HHT showing a strong signal to a Beam-block and little or no signal although the path is not obstructed. The HHT continues to receive data at the normal rate even when power is removed from the Transmitter	The Receiver is seeing light from more than one Transmitter on the same Channel	Ensure that Receivers of all detectors within sight of each other are configured to separate Channels, and that each Transmitter is configured to the same Channel as its own Receiver
The detector output is at Beam-block. The HHT shows the 'RxAlign' flag is set, even though it was not set before the Beam-block occurred	The optical tests which detect misalignment of the Receiver also serve to prevent its giving false gas readings due to a partial obstruction of the beam. If a partial obstruction capable of causing a false alarm persists for longer than the Beam-block delay it will cause a Beam-block that is indicated like this	Check for causes of partial obstruction such as a vehicle, a crane or a build-up of snow or ice intruding into the beam path
	The Receiver has become sufficiently misaligned to cause a Beam-block in a time too short for the warning to be generated	Investigate the cause of the movement. The Receiver may have been struck or the supporting structure may not be sufficiently rigid

We have installed several detectors with similar configurations. One shows a lower response to the plastic test sheets than the others	The inbuilt calibration is for the specified gas, not for solid plastic. The sheets are intended to demonstrate that the detector is working correctly, not to simulate any particular quantity of gas. It is normal for individual units to show widely differing responses to the sheets	If required, the gas response can be tested directly and in situ using the gas cells supplied in the GCK400 kit

14 The Dräger Hand Held Terminal

WARNING

The Dräger Polytron Pulsar has no user-serviceable parts. Unauthorised opening can lead to a safety-related failure of the unit. Any unauthorised opening of the unit invalidates all guarantee claims.

14.1 Description

The Dräger Hand Held Terminal is a robust and weatherproof unit, certified for use in the hazardous area. It replaces the MTL611B Communicator (based on a Psion Organiser) that was formerly supplied. The Hand Held Terminal is used to align and zero the Dräger Polytron Pulsar Transmitter and Receiver and to provide basic configuration and diagnostic functions. Comprehensive configuration and diagnostics are also provided in conjunction with a personal computer located in the non-hazardous area. Thus a new configuration file can be loaded into an internal memory from the PC, and then copied into one or more Dräger Polytron Pulsar's located in the hazardous area. Similarly, the unit can store the internal data-logger records of up to three Dräger Polytron Pulsar's, and then transfer the files to the PC for analysis or transmission.
An adaptor cable (optional) also allows the Hand Held Terminal to be connected to the AI500 Digital Interface, through a port separate from the EIA RS 422/485 that may be hard-wired into a system. It can be used to configure the tag identification string and multi-drop node address of the AI500, and also to link through the AI500 to any of the four Dräger Polytron Pulsar Receivers connected to it. In this way the Terminal provides all the same functions that it would do if connected directly to the remote Receiver in its possibly inaccessible location.

14.2 Battery

The Intrinsic Safety certification requires that only the specified battery type is used and that it be replaced in the non-hazardous area. To gain access to the battery compartment, undo the four captive screws with a Philips screwdriver and remove the transparent cover, noting that the cover is keyed for the correct orientation. With a 2mm hexagon key loosen (but do not remove) the four socket head screws that retain the metal battery cover. Slide the cover outwards until it clears the heads of the screws and remove it. Attach the battery connector, slide the battery into the space provided, replace the covers as they were and tighten the screws. Take care to orient the transparent cover in the correct keyed position or the waterproofing gasket will not be properly compressed.
Note that battery life is reduced at low temperatures. However, the unit switches off automatically whenever no key is pressed for five minutes, so the life is greatly extended in the normal circumstance that the Hand Held Terminal is used intermittently. To conserve the battery it should be removed when the unit is not in use or could be switched on accidentally, for instance in transit.

14.3 Operation

Switch the Hand Held Terminal on by pressing one of the four keys. It can be left to switch off automatically, or be switched off manually by pressing any two keys at the same time. It connects to the Dräger Polytron Pulsar Transmitter (Tx) or Receiver (Rx) through their Intrinsically Safe ports. Unscrew the knurled metal cover and screw in the metal connector of the Hand Held Terminal's integral flying lead. Remember always to replace the waterproof covers to prevent corrosion. The separate mating connector (marked 'Comms Port') mounted on the body of the Hand Held Terminal is for connection to the PC and also provides a convenient sealed receptacle for the flying lead when not in use.
As soon as the Hand Held Terminal is attached to an operating unit (Tx, Rx or AI500) it initiates a two-way dialogue to determine the connection. The screen displays the serial number and tag string of the local unit, together with the current measured data being output from the Receiver. In most systems the data will be available at the Transmitter as well, relayed via the digital link through which the Receiver also controls the Transmitter's flash rate. The data will similarly be available at the AI500, but only after you have chosen which of the four input streams is to be displayed.
Pressing any of the keys switches the display to a series of menus. Each menu offers four choices, corresponding to the four keys. To keep the menu structure simple and intuitive, you are presented with just those menus that are appropriate to the connection that has been determined (Tx, Rx, AI500 or none). Be aware, however, of two circumstances in which the automatic connection process needs your intervention. The first is when the Hand Held Terminal is moved rapidly from one Dräger Polytron Pulsar head to another. It detects a possible new connection when there is a gap in the data stream exceeding 30 seconds. If you move to a new unit quickly enough to fool it then select the menu item **NEW** to identify the new connection. Secondly, when the Receiver switches the Transmitter into its Strong Mode (because gas has been detected or the beam path is attenuated) the rapid stream of data from the Receiver takes precedence over the dialogue between the Transmitter and the Hand Held Terminal. Simply place a hand in front of the lens for a few seconds to break the stream and allow the dialogue to take place.
The menus are designed to be intuitive and self-explanatory. Much the best way to familiarise yourself with them is by using the Hand Held Terminal. The following summaries are intended only to give you an overview of what to expect.

14.4 MENUS WHEN CONNECTED TO Dräger Polytron Pulsar TRANSMITTER

TX MAIN MENU

1 View current readings READ
2 Enter Tx tag (and channel to match Rx) TAG
3 Connect to new Tx or Rx NEW
4 Alignment Mode (if no link to Rx) ON

The ON option is blanked if data from the Receiver shows that the normal link is provided. Otherwise it toggles to OFF as appropriate. The TAG option leads first to a menu to select the starting point for editing the tag string: the string currently in place, all characters blank, or the string saved to memory when a tag was last sent. Often a Transmitter and Receiver are given similar tags, and those of different Dräger Polytron Pulsar's within the same installation follow a numerical or alphabetic sequence. The next screen provides + and - keys to change the channel within its permitted range and the 11 characters of the tag string within the character set:

0123456789 ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]./

NOTICE

that the permitted range of channels is 0..7 for Transmitters labelled '4 to 60m' and 8..11 otherwise. The use of the NEW option is explained above.

14.5 MENUS WHEN CONNECTED TO Dräger Polytron Pulsar RECEIVER

RX MAIN MENU

1 View current readings READ
2 View current settings SETS
3 Connect to new Tx or Rx NEW
4 More… more

The SETS option lists the Receiver's user-selected parameters, such as the measurement span and static warning current for the 4 20mA current loop output. The use of the NEW option is explained above. If your connection to the Receiver is through the AI500 Digital Interface (see below) this option becomes LINK to break the existing link and connect to another Receiver if you wish.

RX ALIGN + ZERO

1 Alignment Mode ALIG
2 Start Rx's self-zeroing ZERO
3 Stop zeroing or alignment STOP
4 More… more

The use of the ALIG and ZERO is explained in "Installing and Commissioning the Dräger Polytron Pulsar" section of the manual.

RX MEMORY MENU

1 Enter Rx tag (and channel to match Tx) TAG
2 Read Logger data from Rx into memory LOG
3 Send User-Settings in memory to Rx USER
4 More… more

The TAG option works as above. LOG allows the choice of File1, File2 or File3 to hold the logger record (which includes the Receiver's configuration), listing the serial numbers and tag strings of the Receivers whose data is currently held.

RX 4 TO 20mA TEST

1 Current + +
2 Current - -
3 Stop test STOP
4 More… more

You can test control equipment connected to the Dräger Polytron Pulsar Receiver by imposing a current on its 4 to 20mA current loop output. + and - allow the test current to be stepped up and down from 0.0 to 20.0mA in 0.5mA increments, starting from 4.0mA. Return the Receiver to its normal output mode with STOP without exiting this menu, or with more to cycle back to 'Rx Main Menu'.

14.6 MENUS WHEN CONNECTED TO AI500 DIGITAL INTERFACE

AI500 MAIN MENU

1 Read tag and node address for RS485 READ
2 Enter new tag and node TAG
3 Connect to new AI500 NEW
4 Link via this AI500 to Rx A, B, C, or D LINK

TAG is as before, except that the permitted range of node addresses is 0..32. All AI500 units respond to requests to Node 0, so that address must not be used in a multidrop. The LINK option leads to a menu choosing between the four Receivers connected to the 'A', 'B', 'C', and 'D' terminals of the AI500 Digital Interface. Provided the selected Receiver is in fact connected, the Terminal will connect to it and show its serial number and tag string to confirm that the link has been successfully established. Remember to break the link (see above) when you are finished.

14.7 MENU WHEN TERMINAL IS NOT CONNECTED

NOT CONNECTED

1 Connect to PC PC
2 View user-settings in memory SETS
3 View note for new users NOTE
4 Connect to Tx, Rx or AI500 TR/A

The PC option lists the serial numbers and tag strings of the Dräger Polytron Pulsar Receivers whose data logger records are available for transfer as File1, File2 and File3 when the appropriate Dräger software is run on the computer. The SETS key lists the user-selectable parameters held in memory (such as the measurement span and static warning current for the 4 20mA current loop output) that can be transferred from the computer and used to reconfigure Receivers in the hazardous area. Note that, by contrast, SETS in the Receiver menu lists the configuration settings currently in place.

14.8 Maintenance

The Dräger Hand Held Terminal requires little routine maintenance. Periodically check the housing and cable for damage that may allow water ingress. If necessary the enclosure may be cleaned using a damp cloth. In the event of damage or suspected failure the unit should be returned to Dräger.
There is a screwdriver adjustment for LCD contrast, accessible through a hole at the bottom right of the screen. Do not change the original factory setting unless you are sure it is no longer correct. In particular, avoid making changes to compensate for a weak battery or extremes of temperature, because the setting will then be wrong in normal circumstances.

WARNING

Never open the housing in a hazardous area.

14.9 Specification

Dimensions:	133 x 145 x 75mm
Weight:	800g
Lead length:	1 metre
Temperature:	-20 °C to 45 °C (operating) for T4 temperature classification
Temperature:	-20 °C to 60 °C (operating) for T3 temperature classification
Weather seal:	IP66/67
Screen type:	Reflective LCD
Graphics:	128 x 128 pixels
Text:	16 lines of 21 characters
Battery:	Duracell or Procell MN1604 Sealed Alkaline 9V
Battery life:	10 hours continuous use at 21 °C
Materials-	
Enclosure:	Polycarbonate
Flying Lead:	Outer sheath, PVC
Cable gland:	Polyamide
Connectors:	Nickel-plated brass
Switches:	PBT

14.10 Electromagnetic compatibility

EN 50081-1
EN 50081-2
EN 61000-6-2
FCC Class A

14.11 Safety information

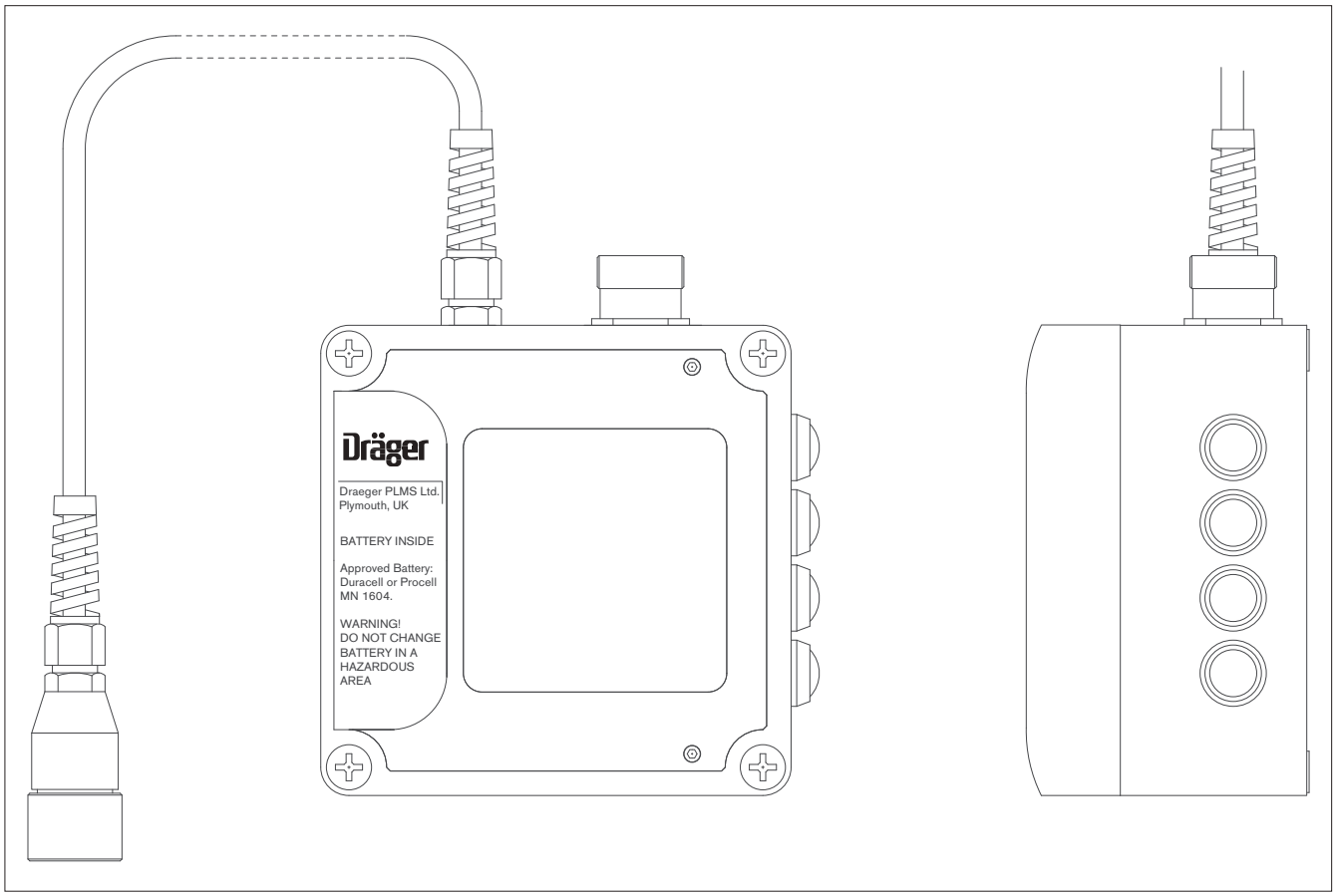
These instructions are intended to inform you of all aspects of the Dräger Hand Held Terminal. It is vital for your safety and that of others that its functions are understood and that every aspect of installation, commissioning and maintenance are carried out correctly. If you are in any doubt about any part of these instructions, any function of the equipment, or any operating procedure, please contact Dräger or your local distributor.
The Dräger Hand Held Terminal is intended for use in hazardous areas in conjunction wit Dräger Polytron Pulsar. In non-hazardous areas it may be connected to the Dräger AI500 Digital Interface or a personal computer. For connection details refer to “The Dräger Polytron Pulsar Digital Interface AI500” section of the Dräger Polytron Pulsar installation manual.
The Dräger Hand Held Terminal is certified and intended for use in hazardous areas that may contain potentially explosive atmospheres. Install and use the Dräger Hand Held Terminal in accordance with the latest local or national regulations.
In Europe the applicable standards include:
EN 60079 ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES
Part 10. Classification of hazardous areas
Part 14. Electrical installations in hazardous areas (other than mines)
Part 17. Inspection and maintenance of electrical installations in hazardous areas (other than mines)
To ensure electrical safety the Dräger Hand Held Terminal should only be used within the parameters described in its certification and must not be used in oxygen enriched atmospheres.
Ensure the construction materials used for the external components of the Dräger Hand Held Terminal are chemically compatible with the intended process application.
Use only approved batteries. Do not change the battery in a hazardous area.

WARNING

No attempt should be made to dissemble the unit in a hazardous area.

The Dräger Hand Held Terminal contains no internal user serviceable parts.
Unauthorised repair or modification may invalidate the hazardous area certification and the Dräger warranty.
In event of suspected failure the unit should be returned to Dräger or the local distributor.

Figure 8: Dräger Hand Held Terminal



15 The Dräger Polytron Pulsar Digital Interface AI500

15.1 Description

The AI500 is a compact DIN/EN rail-mounted unit, normally located in the non-hazardous area. It communicates digitally with one to four Dräger Polytron Pulsar's and provides easy access to their current measured values, their configurations, and their internal data-logger records. The measurements include not only gas reading and signal strength, but such detailed information as supply voltage, temperature, noise level and the x y alignments of Transmitter and Receiver. Data is available through a hard-wired EIA RS 422/485 communications port, a separate port for the Hand Held Terminal (or Communicator), and as an infra-red signal to a Data Wand.
This multiplicity of functions allows the AI500 to be used in systems with different levels of complexity. In a fully-engineered installation the full current and historical data are available continuously to a central system via an EIA RS 485 multidrop. In the simplest, only the 4 20mA signal from each Dräger Polytron Pulsar is used for indication and control action, with states requiring operator attention signalled as static values of the current. When a Dräger Polytron Pulsar is identified as requiring investigation, the operator uses the non-contacting Data Wand to download the diagnostic information into a notebook PC. The file can then be examined locally or e mailed.
In all cases, the Hand Held Terminal (or Communicator) is able to call up any one of the Dräger Polytron Pulsar Receivers connected to the AI500 and has the same functionality as if connected to the field unit at its possibly inaccessible location.

15.2 Environmental

The AI500 must be used only in a safe (non-hazardous) area or within a suitably certified enclosure within the hazardous area. The atmosphere should be non-condensing and free of contaminants or pollutants harmful to electronic equipment.
The working temperature range is 0 °C to +55 °C for individual units with free air circulation, and 0 °C to +45 °C for multiple units in contact on the mounting rail.
NOTE: where temperatures exceed 45 °C, multiple units stacked on a mounting rail horizontally or vertically should be spaced a minimum of 15mm apart to allow air circulation

15.3 Power Supply

Power Supply: 24V DC nominal
Supply Range: 20 to 32V
Consumption: 3W maximum
Internal Fuse: 250mA

15.4 Mechanical

Mounting:
35mm symmetrical rail (to EN50 022)
32mm asymmetrical rail (to EN50 035)
15mm symmetrical rail (to EN50 045)
Dimensions:
Above rail 80mm (with Connector 1: +10mm)
Across rail 80mm (with Connector 2 and 3: +20mm)
Along rail 25mm
Weight: 120g

15.5 Electromagnetic compatibility

EN 50081-1
EN 50081-2
EN 50082-1
EN 50082-2
EN 61000-6-2
FCC Class A

15.6 Infra-red output

Serial binary data is output via the Data Wand DW100 to an IBM-PC compatible portable computer running Dräger proprietary software. The infra-red coupling requires the tip of the Wand to be brought within 30mm of the emitters adjacent to Connector 1. Current measurements are output every 1.5 sec maximum, complete historical data for four Dräger Polytron Pulsar's takes 12 sec. The infra-red output is automatically inhibited when the unit is addressed via the EIA-RS-422/485 bus.

15.7 Connector 1: Power AND Dräger Polytron Pulsar Digital I/O

Terminal:	Function:
1	Common
2	Digital I/O Dräger Polytron Pulsar Receiver A
3	Common
4	Digital I/O Dräger Polytron Pulsar Receiver B
5	Common
6	Digital I/O Dräger Polytron Pulsar Receiver C
7	Common
8	Digital I/O Dräger Polytron Pulsar Receiver D
9	Common (Power supply 0V)
10	Common (Power supply 0V)
11	Power supply +24V
12	Power supply +24V

Removable polarised connector.
Phoenix Contact MST BT2.5/12-ST-5.08, 2.5mm^2 (14AWG)
Terminals 1,3,5,7,9,10 and 11, 12 are linked internally.
The Digital I/O ports A, B, C and D communicate bi directionally with up to four Dräger Polytron Pulsar Receivers. They are compatible with all variants of the Dräger Polytron Pulsar but not with GD series detectors.
Digital current loop:
Logic 1 (Mark): 0mA
Logic 0 (Space): 5mA
Data rate: 1200 bits / s
Protocol: Proprietary
Data integrity: CRC-16 checksum

15.8 Connector 2: EIA-RS-422/485 Serial Port

Terminal:	EIA-RS-422/485 Function:
13	0V (ref)
14	+5V dc out (100mA max)
15	TXB (+)
16	TXA (-)
17	RXB´ (+)
18	RXA´(-)

Removable polarised connector
Phoenix Contact MC 1.5/06-ST-3.81, 1.5mm^2 (16AWG)
For two-wire operation Terminals 15, 17 and 16, 18 can be linked internally with jumpers, accessed by removing the front cover. The driver capability allows up to 32 AI500 units to be addressed in a in a four-wire multidrop system, giving access to a theoretical maximum of 128 Dräger Polytron Pulsar's. In practice, the number of units will normally be determined by considerations of polling rate. The node address of each unit in the range 1..32 is held in non-volatile memory and can be configured using the Dräger Hand Held Terminal (or Communicator). All units respond to the node address 0. Similarly, each unit can be assigned an 11-character tag string to identify it independently of its node address. This, together with the ability to assign tag strings to individual Dräger Polytron Pulsar's, allows quick and certain checking of the complete system at commissioning time.
The markings A, B, A´, B´ are as defined in ISO/IEC 8482.
The markings (+) and (-) show the polarity for Binary 1, stop-bit and idle state. The host (master) system must provide idle-state biasing with this polarity. The +5V dc supply is provided for that purpose, or to power an RS485-to-RC232C converter, such as the Amplicon 485F9i. The port, including the 5V supply, is electrically isolated from the 24V supply and the Dräger Polytron Pulsar wiring.

15.9 Connector 3: Hand Held Terminal Port

Terminal:	Optical Isolator Function:
19	Emitter (volt-free output -)
20	Collector (volt-free output +)
21	Anode (volt-free input +)
22	Cathode (volt-free input -)

Removable polarised connector
Phoenix Contact MC 1.5/06-ST-3.81, 1.5mm^2 (16AWG)
The adaptor cable Dräger 2350326 allows connection of the Dräger Hand Held Terminal (or Communicator). The port complies with the requirements of its Intrinsic Safety certification.

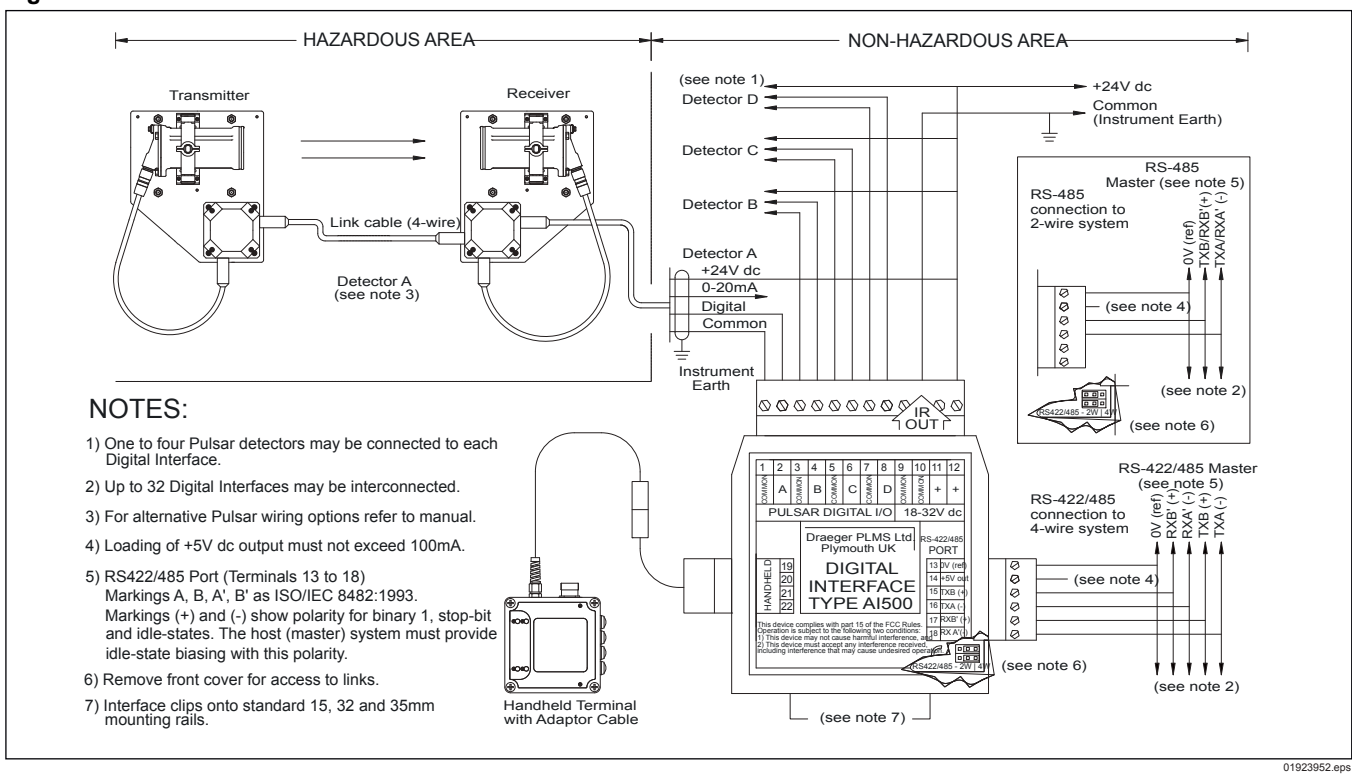
15.10 Communicating with the AI500 Digital Interface

For most purposes the AI500 can be used with equipment and software supplied by Dräger, relieving the user of the need to know the details of its digital communications. Information can be provided for writers of software for a remote processor, acting as Master of a multidrop system, to address one or more AI500 units as Slaves. For this purpose the AI500 acts as a dual-port memory which is automatically filled with the most up-to-date values for a wide range of measured parameters from the connected Dräger Polytron Pulsar's (gas reading, signal and noise levels, x y alignments of Transmitter and Receiver, supply voltage, temperature etc), their internal configurations (gas calibration, serial number, tag designation etc), and their internal data logger records. The data is available for immediate access at data rates of 1200 or 9600 baud.

15.11 Summary of Dräger Protocol

All data is binary in frames of fixed length. Bytes are 8-bit, non-parity, sent least significant bit first with one stop bit. A Short Format frame of five bytes is used for simple commands and acknowledgements. A Long Format frame of 24 bytes or an Extra-long Format frame of 263 bytes is used to transfer data and configurations. Configurations are 16 byte blocks, including an internal CRC 16 checksum in addition to the CRC 16 checksum used to transmit them. If synchronisation between Master and Slave is lost then any garbled or incomplete frame is discarded after a checksum error, a stop bit error, or the absence of an expected start-bit after two byte durations.

Figure 9: Connection from the field device to the AI500



NOTES:

1) One to four Pulsar detectors may be connected to each Digital Interface.
2) Up to 32 Digital Interfaces may be interconnected.
3) For alternative Pulsar wiring options refer to manual.
4) Loading of +5V dc output must not exceed 100mA.
5) RS422/485 Port (Terminals 13 to 18)
   Markings A, B, A', B' as ISO/IEC 8482:1993.
   Markings (+) and (-) show polarity for binary 1, stop-bit and idle-states. The host (master) system must provide idle-state biasing with this polarity.
6) Remove front cover for access to links.
7) Interface clips onto standard 15, 32 and 35mm mounting rails.

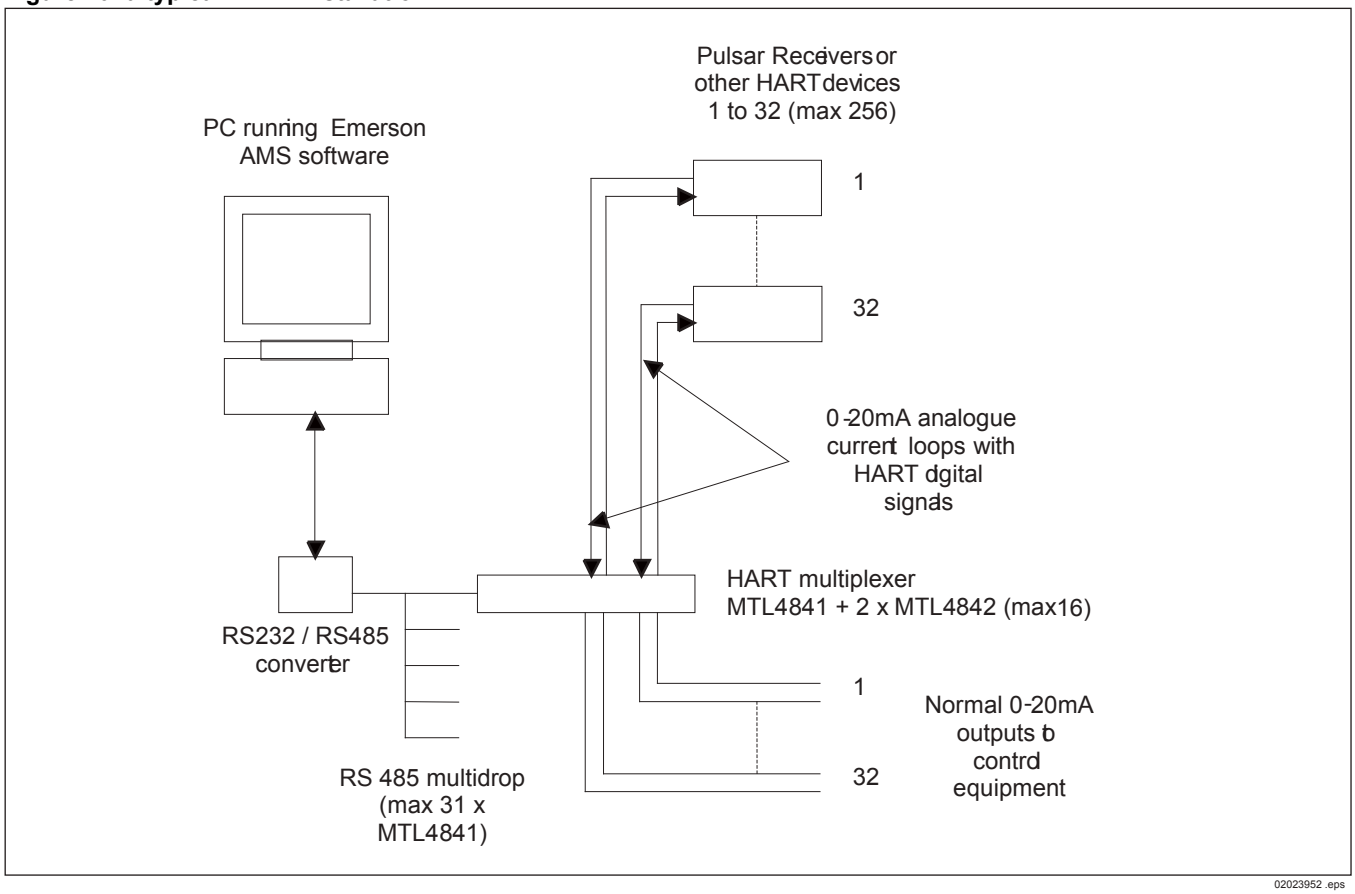
01923952.eps

16 Using the Dräger Polytron Pulsar with HART

16.1 Description

The HART enhanced Dräger Polytron Pulsar allows basic digital communications between the Receiver in the field and the safe area without the need for extra cable cores. The digital signals are overlaid on the 0 20mA analogue current as a symmetrical modulation, ensuring that the integrity of the normal reading remains unaffected. The Dräger Polytron Pulsar is fully compatible with Version 5 standards for a slave device published by the Hart Communication Foundation (HCF). Thus Dräger Polytron Pulsar inputs to a multiplexer can be mixed with those from any other HART-compatible device, including Dräger point detectors:

Figure 10: a typical HART installation



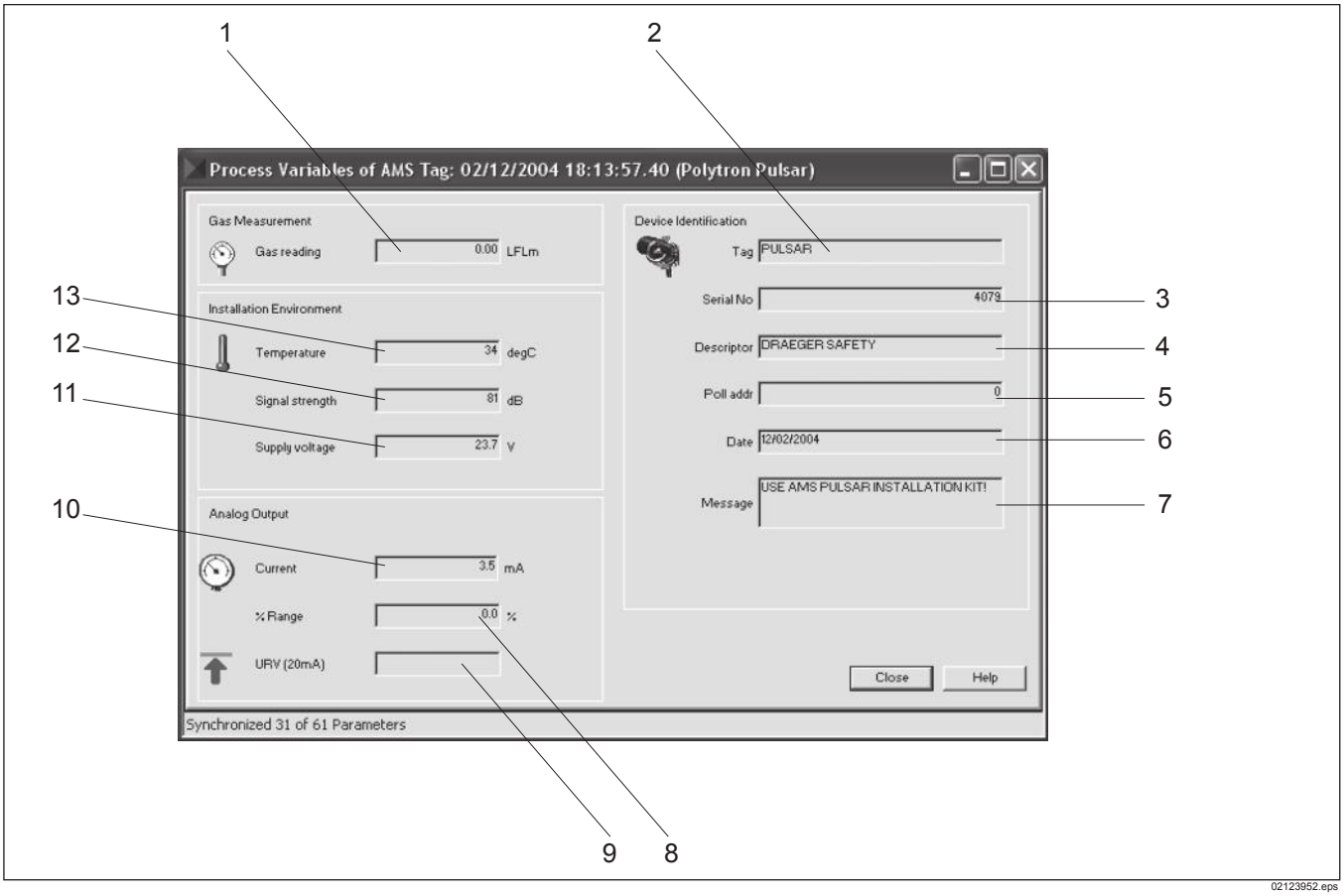
Normally the multiplexer is interfaced to a central computer running the Asset Management System (AMS) from Emerson Process Management. Although rudimentary operation is possible using default settings (for instance using a HART handheld communicator), it is important to use the AMS Pulsar Installation Kit that implements the Dräger Polytron Pulsar-specific Device Description (DD) and Windows Resource File (WRF) to customise AMS. The screen displays it provides for the operator are shown in Figures 15 to 24, which include the context-specific help texts available by pressing the F1 key. Users not wishing to use AMS but to write custom software addressing Dräger Polytron Pulsar directly through its HART interface should refer to the HART Commands table (available on request) which lists the Universal, Common-Practice, and Device-Specific commands that are implemented.

It is important to note that a HART Hand Held Communicator does not replace the Dräger Polytron Pulsar Hand Held Terminal, since it lacks the real-time graphics display required for alignment and zeroing. Certain configuration settings, which normally remain at their factory-default values, also require the Dräger Polytron Pulsar Hand Held Terminal to install PC-generated configuration files. The Terminal is likewise required to download data-logger records from the Receiver. In general the strength of the HART protocol lies in its convenience for basic maintenance tasks. As such it offers relatively slow, low integrity communications. Consequently, the number of devices of all kinds that can be addressed in a HART system is normally limited by the response times to operator requests and, most importantly, HART data should never be used for safety-critical purposes.

For installation instructions, refer to the documentation supplied by the manufacturer of the multiplexer to be used, and by Emerson for the AMS system. Although Dräger Polytron Pulsar is not intended to be used in a HART multidrop configuration (not to be confused with the RS485 multidrop shown above) for normal operation, it is possible for up to ten Dräger Polytron Pulsar Receivers to be so connected in the absence of their Transmitters. For instance, Receivers could be powered up sequentially on a workshop bench to configure their individual tags before they are installed. The HART tag corresponds to the first eight characters of the longer Dräger Polytron Pulsar Receiver Tag, so the Dräger Polytron Pulsar Hand Held Terminal provides an alternative way to set and check the tags that will be used for HART addressing.

17 AMS operator screens and help texts

Figure 11: Process variables of AMS Tag



1 Measurement of concentration times path length, giving an indication of the risk potential due to flammable gases and vapours. LFL (lower flammable limit) means the same as LEL (lower explosive limit). As an example, a concentration of 50% LFL filling 3 metres of the beam path reads 1.5 LFLm.

2 Tag- Text that is associated with the Field Device installation. This text can be used in any way. A recommended use is as a unique label to a plant that correlates to a Field Device label: a plant drawing, or on a Control System. It can also be used as a data link layer address handle. Be aware that the HART tag is just the first 8 characters of the 11 character tag that can be read and set by the Dräger Polytron Pulsar Hand Held Terminal.

3 The unique serial number shown on the exterior label of the Dräger Polytron Pulsar Receiver, where it is prefixed by 70... (The transmitter will have an unrelated serial number because Dräger Polytron Pulsar Transmitters of the same type can be interchanged at will.)

4 Descriptor- Text that is associated with the Field Device. This text can be used by the user in any way. There is no specific recommended

5 Dräger Polytron Pulsar is not intended to be used in a HART multidrop for normal operation. However, several Pulsar Recievers can be so connected for bench testing in the absence of a Transmitter. Each Receiver will then be in Beam-Block and contribute 2mA to the total signal current.

6 Date- Gregorian calendar date that is stored in the Field Device. This date can be used by the user in any way. There is no specific recommended use.

7 Message- Text that is associated with the Field Device. This text can be used by the user in any way. There is no recommended use.

8 Open Path: The gas reading expressed as a percentage of the 4-20mA range (to a maximum of 254%). Duct-mounted: the gas reading expressed as a percentage of the 4-20mA range (to a maximum of 254%). For the particular case of a Duct-mounted Dräger Polytron Pulsar configured to read 0-100% LFL for 4-20mA, this number can be read directly as %LFL

9 Upper Range Value - The gas reading which produces an Analogue Output of 20mA and a Percent Range of 100%. It is not recommended to set the URV below 4.0 LFLm unless the operating environment is clean and dry, the ambient temperature is relatively stable and the measurement beam will not be obstructed.

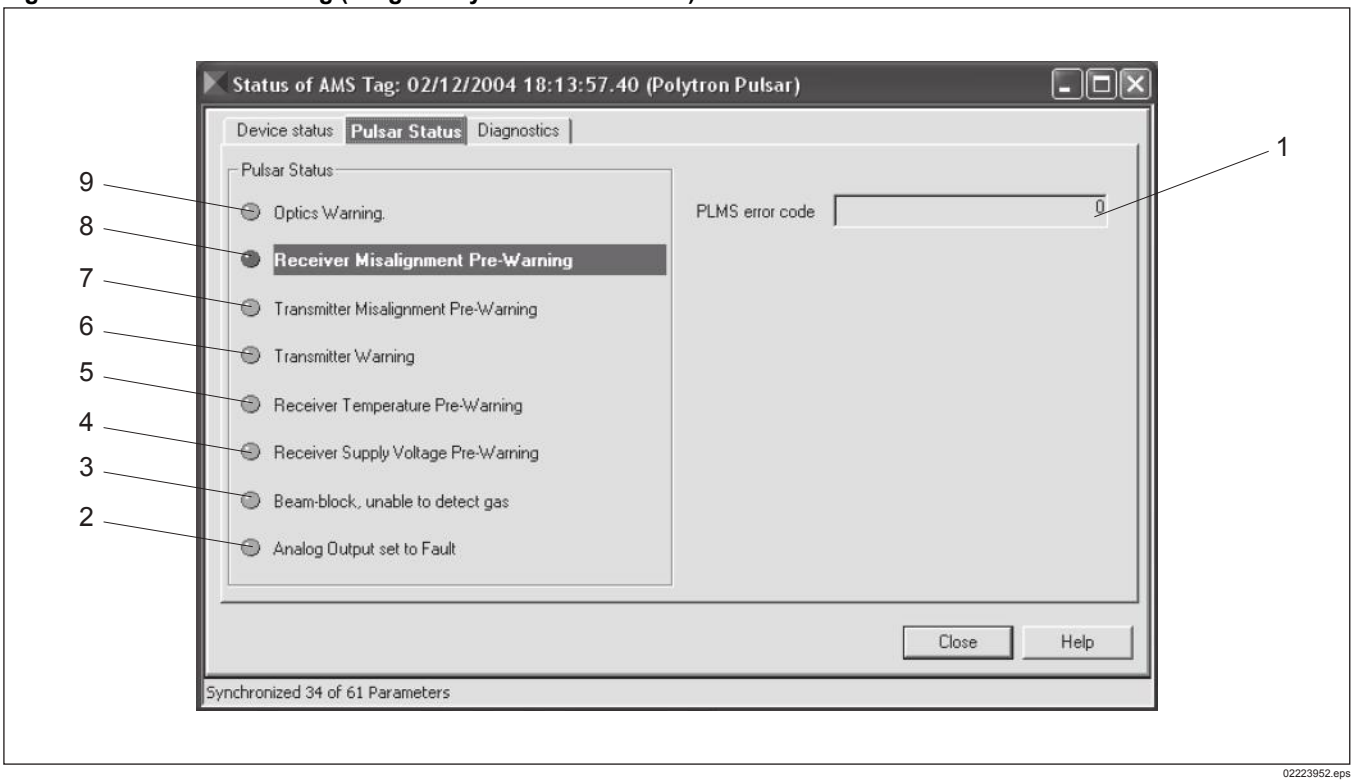
10 Analog Output Value- Value that tracks the Digital Value representation, under normal operating modes.

11 The Supply voltage measured by the Receiver is the applied voltage less the voltage drop in the cable.

12 Signal strength depends on the operating distance and the presence of fog. Misalignment of the Transmitter and the Receiver and dirt on their lenses can also affect this value.

13 The internal temperature of the Dräger Polytron Pulsar Receiver. Normally a few degrees above ambient temperature due to internal power consumption and the lens heater.

Figure 12: Status of AMS Tag (Dräger Polytron Pulsar Status)



1 Please state this error code if you need assistance from the service support centre.

2 The 4-20mA Analog Output is at Fault level (<1mA) because of a Hardware Fault or because Beam-Block has timed out to Fault. Please see Diagnostics Tab.

3 The 4-20mA Analog Output is at Beam-block level (2mA). The Dräger Polytron Pulsar is unable to detect gas for some reason. Please see Diagnostics Tab.

4 The supply voltage at the Receiver end of its cable is out of limits. This is not yet affecting the operation.

5 The internal temperature of the Receiver is unusually high or low. This is not yet affecting the operation.

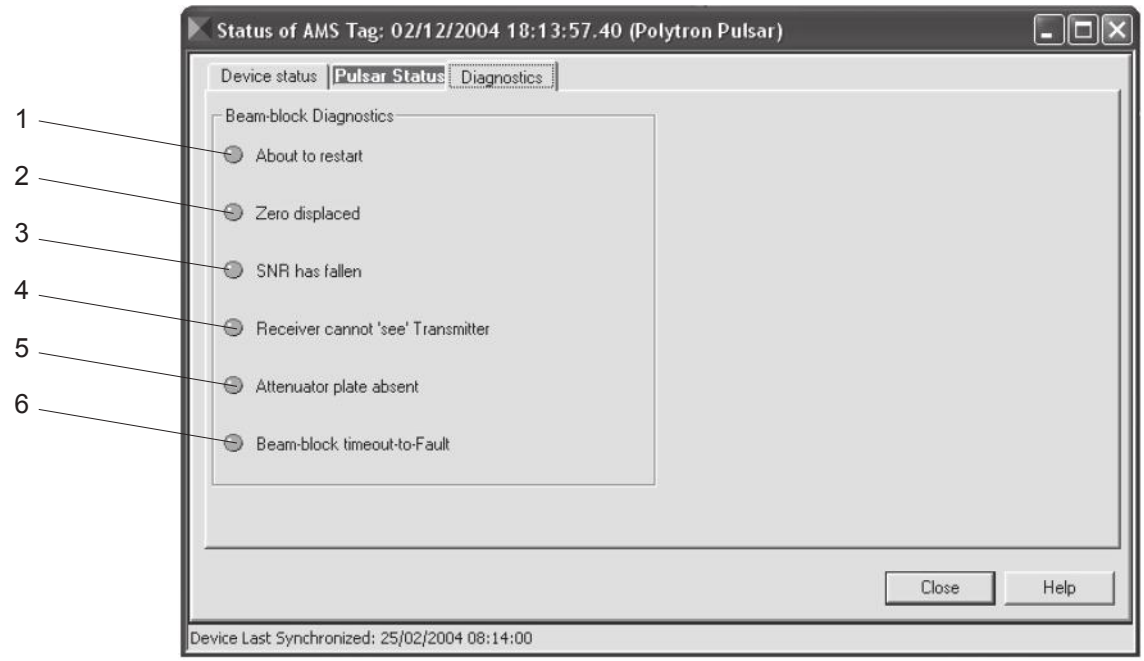
6 Transmitter reports some Xenon tube mistriggering OR the digital link between the Receiver and the Transmitter has broken. The Dräger Polytron Pulsar remains operational but should be serviced if this indication persists. The sensitivity to gas is not affected.

7 The Transmitter is not pointing exactly towards the Receiver. This is not yet affecting the operation.

8 Receiver Misalignment Pre-Warning", The misalignment of the Receiver towards the Transmitter exceeds 50% of the allowed range OR the Receiver lens is partially obstructed. This is not yet affecting the operation.

9 Warning of Attenuator plate absent from Transmitter OR pre-warning of dirty lens. Please see Diagnostics Tab.

Figure 13: Status of AMS Tag (Diagnostics)



1 The Analog Output is at Beam-block level (2mA). However, the cause has been removed and the Dräger Polytron Pulsar is expected to restart operation in a few seconds.

2 Gas reading shows a negative value. Before re-zeroing please check for obstructions in the beam, misalignment or lens contamination.

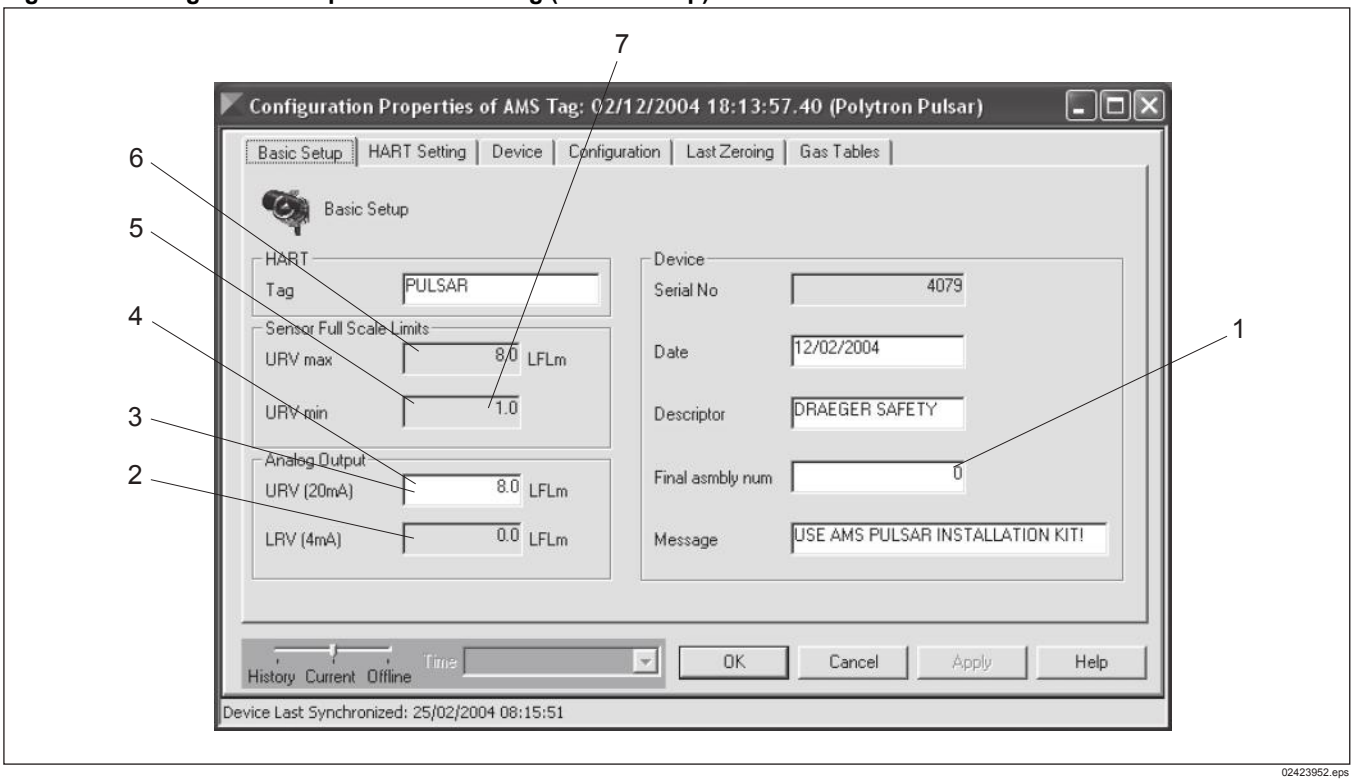
3 The signal-to-noise ratio is too poor for measurement. This could be due to dense fog or an obstruction in the beam path.

4 The Receiver is unable to 'see' the Transmitter. Possible causes: (1) Obstruction in beam path (2) Receiver and Transmitter not set to the same channel (3) A nearby Dräger Polytron Pulsar set to the same channel (4) Transmitter not powered (5) Transmitter and/or Receiver grossly misaligned.

5 The Optics Warning flag is set because the signal strength is very high. Please check that the appropriate attenuator plate is fitted to the Transmitter for the Tx/Rx operating distance

6 The Analog Output is at Fault level (<1mA) because a Beam-block state has persisted for longer than the configured time limit

Figure 14: Configuration Properties of AMS Tag (Basic Set up)



1 Final Assembly Number- Number that is used for identification purposes, and is associated with the overall Field Device.

2 Lower Range Value - For Dräger Polytron Pulsar this value is always zero.

3 Duct-mounted: Upper Range Value - The gas reading which produces an Analog Output of 20mA and a Percent Range of 100%. For a duct-mounted Dräger Polytron Pulsar the URV (in units of LFLm) is set equal to the path length through the gas (in metres) so that the URV corresponds to 100%LFL.

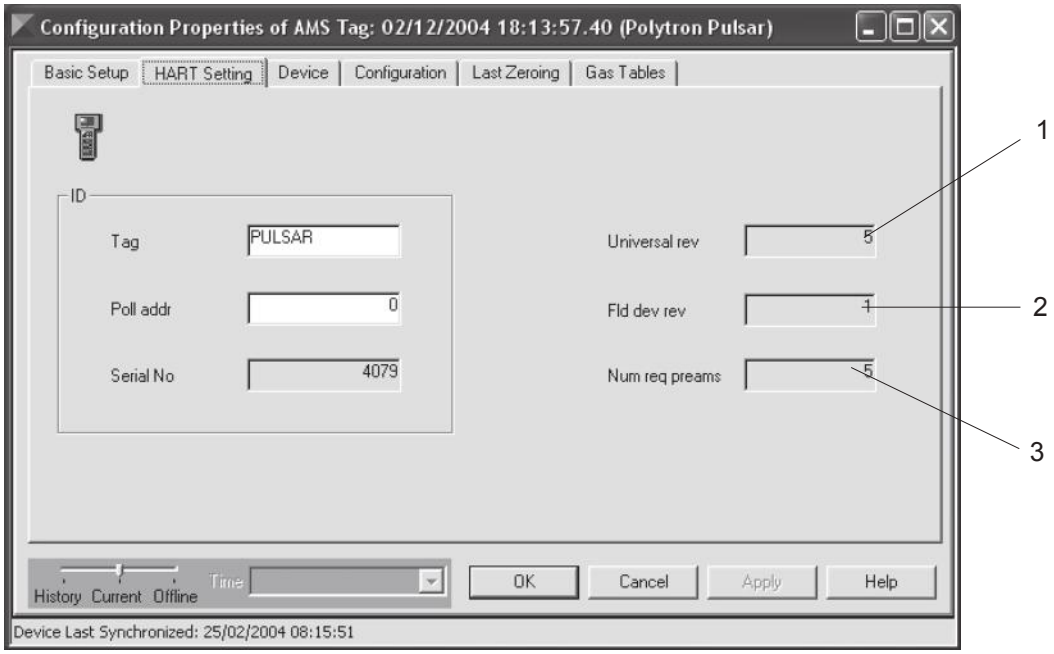
4 Open Path: Upper Range Value - The gas reading which produces an Analog Output of 20mA and a Percent Range of 100%. It is not recommended to set the URV below 4.0 LFLm unless the operating environment is clean and dry, the ambient temperature is relatively stable and the measurement beam will not be obstructed.

5 Open Path: Lower Limit to which the Analog output Upper Range Value can be set in any circumstances. It is not recommended to set the URV below 4LFLm unless the operating environment is clean and dry, the ambient temperature is relatively stable and the measurement beam will not be obstructed.

6 Upper limit of gas reading to which the Analog output Upper Range Value can be.

7 Duct-mounted: For a duct-mounted Dräger Polytron Pulsar the Upper Range Value (in units LFLm) is set equal to the path length through the gas (in metres) so that the URV corresponds to 100%LFL. Therefore this lower limit determines the minimum permitted path.

Figure 15: Configuration Properties of AMS Tag (HART Setting)



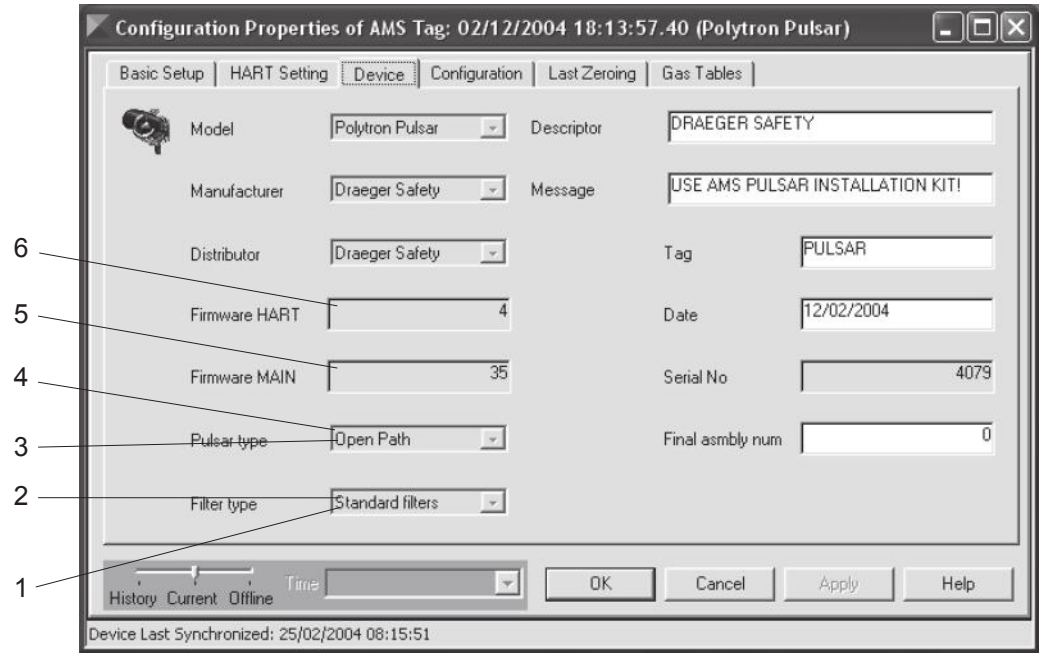
02523952.eps

1 Universal Revision- Revision of the Universal Device Description that the Field Device conforms to.

2 Field Device Revision- Revision of the Field Device Specific Device Description that the Field Device conforms to.

3 Number of Request Preambles- Number of Preambles required from the Host request by the Field Device.

Figure 16: Configuration Properties of AMS Tag (Device)



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1 Ethylene filters: Version of Dräger Polytron Pulsar optimized to measure Ethylene (Ethene) in the beam path.

2 Standard filters: Version of Dräger Polytron Pulsar optimized to measure most common hydrocarbons, including the alkane series, but not Ethylene (Ethene).

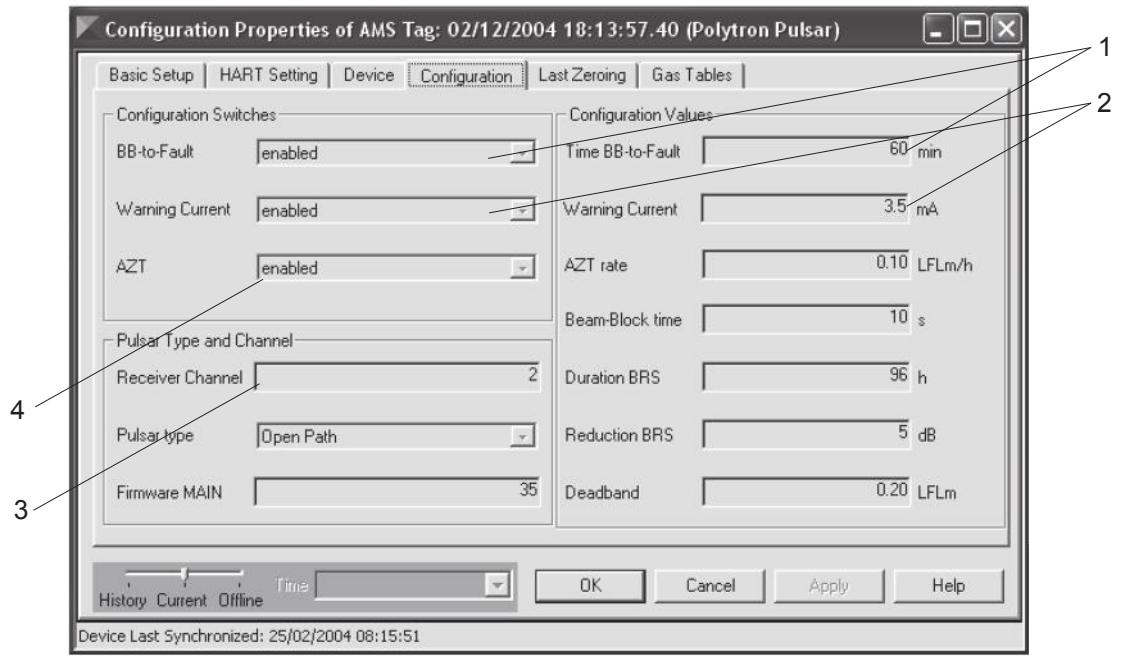
3 Duct-mounted: This Dräger Polytron Pulsar is a version to be installed within ventilation ducts. In this special situation any gas is expected to be uniformly diluted across the beam path. The Dräger Polytron Pulsar can then be configured to output 0-100 %LFL.

4 Open Path: This is the standard configuration of the Dräger Polytron Pulsar, not the Duct-Mounted version.

5 Issue of the Receiver Main Processor firmware (23 = version 2.3 etc). This processor is used for the Dräger Polytron Pulsar's measurement functions. Unlike the separate processor used for HART communications it is field-programmable for future upgrade.

6 Issue of the Receiver HART Processor firmware (23 = version 2.3 etc). This processor is used for the Dräger Polytron Pulsar's HART communication. It is separate from the processor used for Dräger Polytron Pulsar's measurement functions. It is fixed at the time of manufacture.

Figure 17: Configuration Properties of AMS Tag (Configuration)



02723952.eps

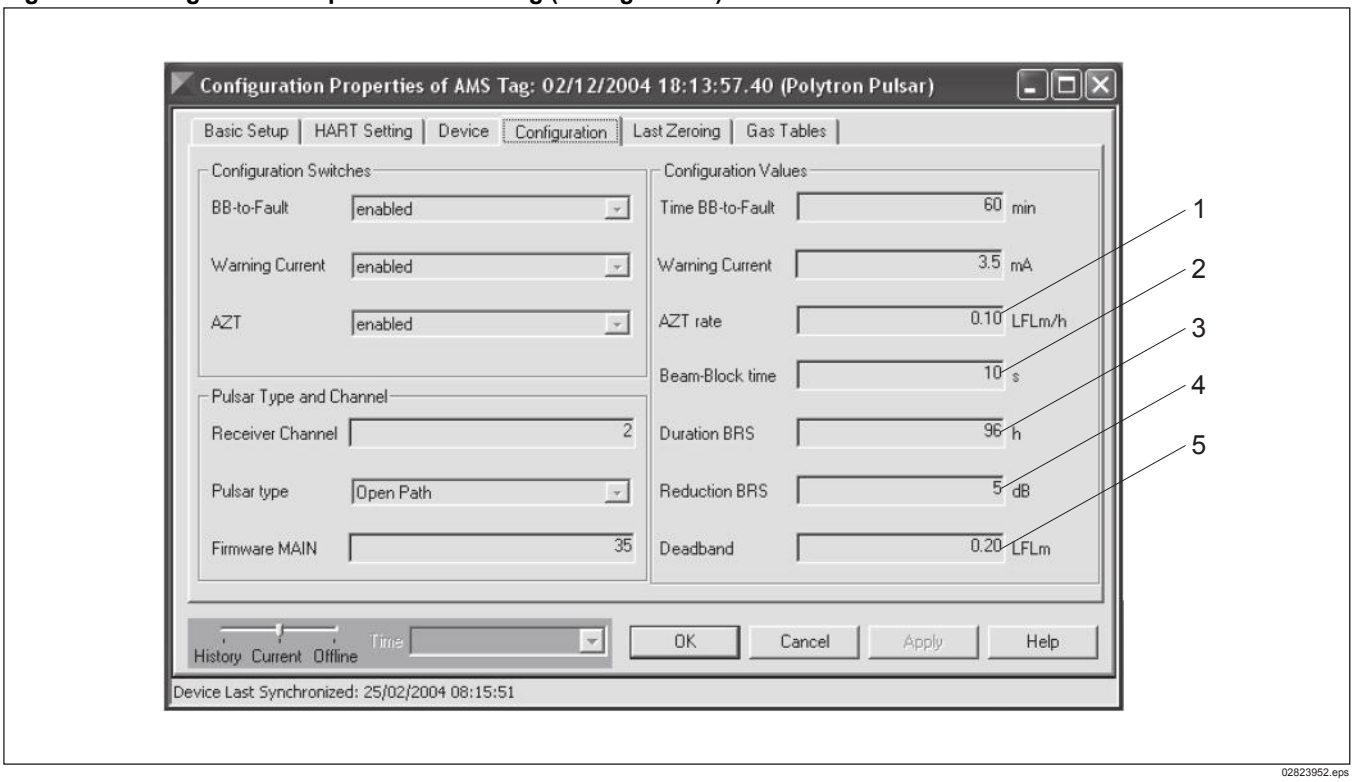
1 If BB timeout to Fault is enabled a Beam-Block that persists for longer than the configured time limit will cause the Analog Output to be Fault level (<1mA).

2 If the Warning Current output is enabled then any of the warnings listed below cause this output in place of 4.0 mA, provided there is no gas reading exceeding the deadband. Thus it provides an indication that more information is available, but does not affect the measurement of gas. The default setting 3.5mA causes the Dräger Regard Optical card to display 'WARN'. The warnings are for: Optics; Receiver Supply; Receiver temperature; Receiver Alignment; Transmitter; Transmitter Alignment. Please refer to the Dräger Polytron Pulsar Status tab for their individual descriptions.

3 Proper selection of Channel avoids interference with other instruments nearby. Receiver and Transmitter must have the same Channel whereas neighbouring Dräger Polytron Pulsar's should be set to a different Channel.

4 Auto-Zero Tracking allows small gas readings that persist for a long time to be interpreted as zero drift and automatically cancelled. It must not be enabled in installations where a slow build up of gas concentration is possible.

Figure 18: Configuration Properties of AMS Tag (Configuration)



1 Auto Zero Tracking rate - When enabled AZT allows small gas readings that persist for a long time to be interpreted as zero drift and automatically cancelled. This value is changed automatically when you change the URV for any Duct-Mounted Dräger Polytron Pulsar, or for an Open Path Dräger Polytron Pulsar below 4.0 LFL m.

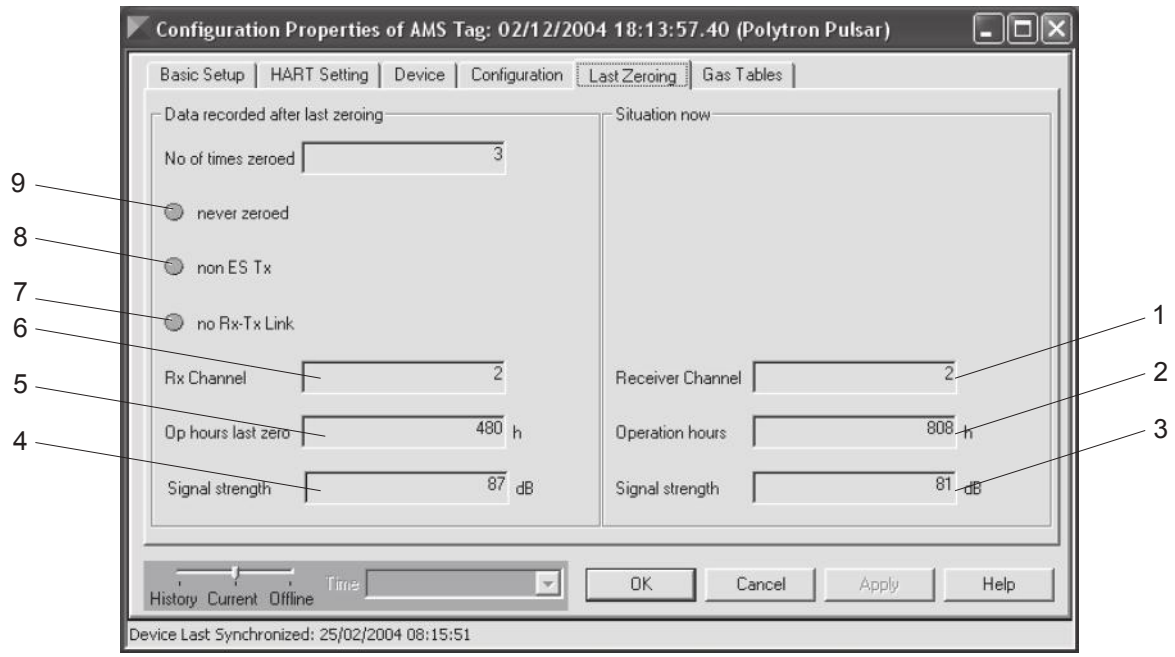
2 If the beam is obstructed (or Dräger Polytron Pulsar is unable to provide a valid gas reading due to any other reason) for longer than this configured time limit then the Analog Output will be at Beam-block level (2mA).

3 Duration for Best Recent Strength. This is one of two parameters Dräger Polytron Pulsar uses to determine whether the lenses need cleaning. Dirty lenses cause a continuing loss of signal strength which is not immediately distinguishable from the day-to-day variations caused by fog etc. The Optics Warning is issued only when a signal loss greater than the 'Reduction BRS' parameter persists for longer than 'Duration BRS'.

4 Reduction in Best Recent Strength. This is one of two parameters Dräger Polytron Pulsar uses to determine whether the lenses need cleaning. Dirty lenses cause a continuing loss of signal strength which is not immediately distinguishable from the day-to-day variations caused by fog etc. The Optics Warning is issued only when a signal loss greater than the 'Reduction BRS' parameter persists for longer than 'Duration BRS'

5 Baseline deadband (LFLm) - The threshold gas reading that causes the Analogue Output to rise above either 4mA or the Warning Current. It ensures that insignificant fluctuations around the baseline are not visible. This value is changed automatically when you change the URV for any Duct-Mounted Dräger Polytron Pulsar, or for an Open Path Dräger Polytron Pulsar below 4.0 LFLm.

Figure 19: Configuration Properties of AMS Tag (Last zeroing)



1 Proper selection of Channel avoids interference with other instruments nearby. Receiver and Transmitter must have the same Channel whereas neighbouring Dräger Polytron Pulsar's should be set to a different Channel.

2 Duration Dräger Polytron Pulsar has operated. This total is maintained by a non-volatile memory within the Dräger Polytron Pulsar Receiver. A period up to 2 hours may be lost when the Receiver is re-powered.

3 Signal strength depends on the operating distance and the presence of fog. Misalignment of the Transmitter and the Receiver and dirt on their lenses can also affect this value.

4 Signal strength recorded at time of last zeroing. This value is subsequently compared with the Best Recent Strength to determine whether the lenses of the Transmitter and Receiver need cleaning.

5 The value of 'Operation Hours' recorded the most recent time the Dräger Polytron Pulsar was zeroed.

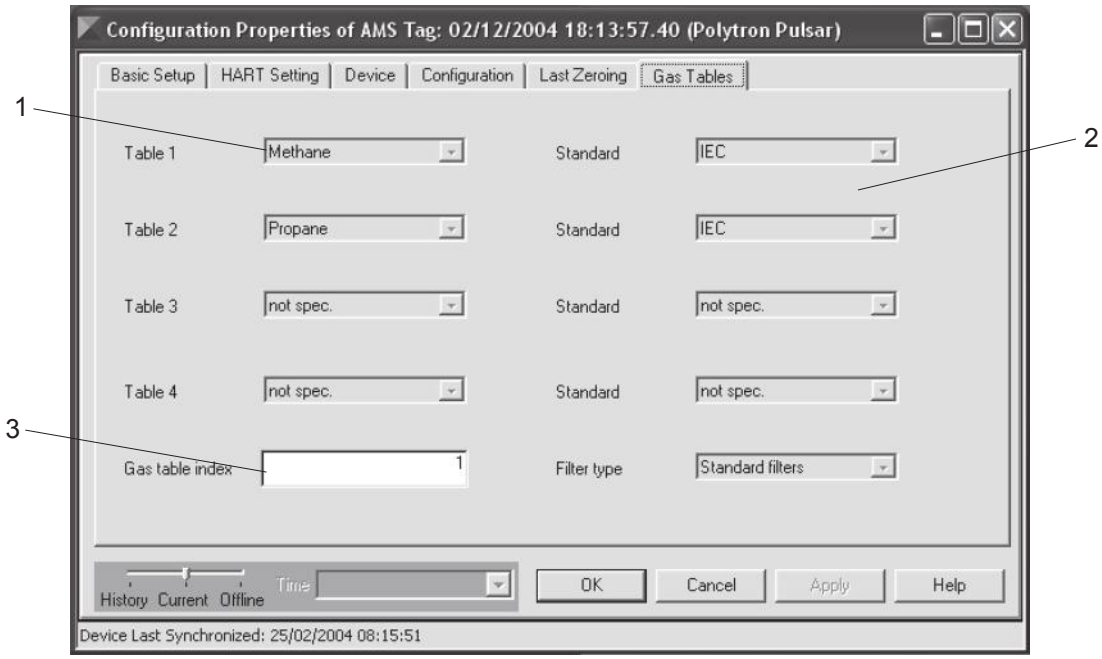
6 The Dräger Polytron Pulsar was set to this channel when last zeroed.

7 The Dräger Polytron Pulsar was last zeroed without the data link connected between Receiver and Transmitter.

8 The Dräger Polytron Pulsar was last zeroed with other equipment than an ES (2/4Hz Enhanced Speed)

9 Device has never been zeroed. In this case further data corresponding with the last zeroing are of no meaning.

Figure 20: Configuration Properties of AMS Tag (Gas table)



1 Up to four Gas Tables can be factory-installed in the Dräger Polytron Pulsar Receiver. One of those can be selected to best suit the application. Unsuitable selection may lead to incorrect readings and alarm levels.

2 Standard of LEL values being used to calculate table
IEC: IEC 60079-20
EN50054: EN50054
NIOSH: NIOSH ICSC
not spec.: This table is empty.
unknown: Calibration standard unknown in this version of the device description. Contact the supplier for an upgraded version.

3 This of the four Gas Tables is being used to calibrate and linearise the gas reading.