AP1 Carbon Probe

User Guide

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Eurotherm®

by Schneider Electric

Legal Information

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Eurotherm Limited, Schneider Electric or any of its affiliates or subsidiaries shall not be responsible or liable for misuse of the information contained herein.

If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Eurotherm Limited software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

Note: Electrical equipment must be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Note: A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment, and has received safety training to recognize and avoid the hazards involved.

Safety and EMC

Reasonable Use and Responsibility

The safety of any system incorporating this product is the responsibility of the assembler/installer of the system.

The information contained in this manual is subject to change without notice. While every effort has been made to improve the accuracy of the information, your supplier shall not be held liable for errors contained herein.

This probe is intended for industrial applications.

Use in other applications, or failure to observe the installation instructions of this manual may compromise safety or EMC. The installer must ensure the safety and EMC of any particular installation.

Failure to use approved software/hardware with our hardware products may result in injury, harm, or improper operating results.

Please Note

Electrical equipment must be installed, operated, serviced, and maintained only by qualified personnel.

No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment.

The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Intended Use

The product described or affected by this document, together with software and options, is the AP1 Carbon Probe (referred to herein as “carbon probe”, or "probe"), intended for industrial use according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, a risk assessment must be performed in respect of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component within a machine or process, you must ensure the safety of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

During commissioning, ensure all operating states and potential fault conditions are carefully tested.

Ensure correct installation.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

HOT PROBE, BURN RISK

Take care when removing a probe from a hot furnace as the probe may be extremely hot. Always use suitable Personal Protective Equipment (PPE).

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not disassemble, repair or modify the equipment. Contact your supplier for repair.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

INOPERABLE EQUIPMENT

Introduce (or remove) the probe into (or out of) a hot furnace in stages of 25mm (1in) per minute.

Do not place a hot probe on a cold surface.

Failure to follow these instructions can result in injury or equipment damage.

> **⚠ CAUTION**
>
> **INOPERABLE EQUIPMENT**
>
> Inadequate or incorrect probe air cleaning may lead to incorrect readings.
>
> CHECK AND ADJUST as necessary, at least ONCE PER DAY.
>
> **Failure to follow these instructions can result in injury or equipment damage.**

> **⚠ CAUTION**
>
> **INOPERABLE EQUIPMENT**
>
> When screwing the probe in or out of the pipe fitting, use the gland nut on the carbon probe sheath.
>
> Do not, under any circumstances, use the sensor head for tightening or loosening the probe.
>
> **Failure to follow these instructions can result in injury or equipment damage.**

Symbols

Various symbols may be used on the probe. They have the following meaning:

⚠ Risk of electric shock.

Take precautions against static.

The RCM is a trademark owned by Australian and New Zealand Regulators with RCM mark.

Complies with the 40 year Environment Friendly Usage Period.

Hazardous Substances

This product conforms to European **R**estriction **o**f **H**azardous **S**ubstances (RoHS) (using exemptions) and **R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emicals (REACH) Legislation.

RoHS Exemptions used in this product involve the use of lead. China RoHS legislation does not include exemptions and so lead is declared as present in the China RoHS Declaration.

Californian law requires the following notice:

⚠ WARNING: This product can expose you to chemicals including lead and lead compounds which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to: http://www.P65Warnings.ca.gov

Expected Operating Life

At elevated temperatures, the operating life of the carbon probe is reduced to the following:

- Up to 1000°C (1832°F) : 12 months
- 1000°C -1050°C (1832°F - 1922°F) : 6 months
- Over 1050°C (1922°F) : severely reduced

Introduction

The AP1 Carbon Probe (referred to in this document as the ‘probe’) is a consumable item, like a thermocouple, which is mounted with its tip in contact with the furnace atmosphere, ideally close to the working zone.

The probe produces an output voltage which, in conjunction with the process temperature and atmosphere, can be interpreted in terms of the atmosphere carbon potential of the furnace. See Appendix A - Reference Tables.

The probe is designed to be used with controllers with a high impedance input.

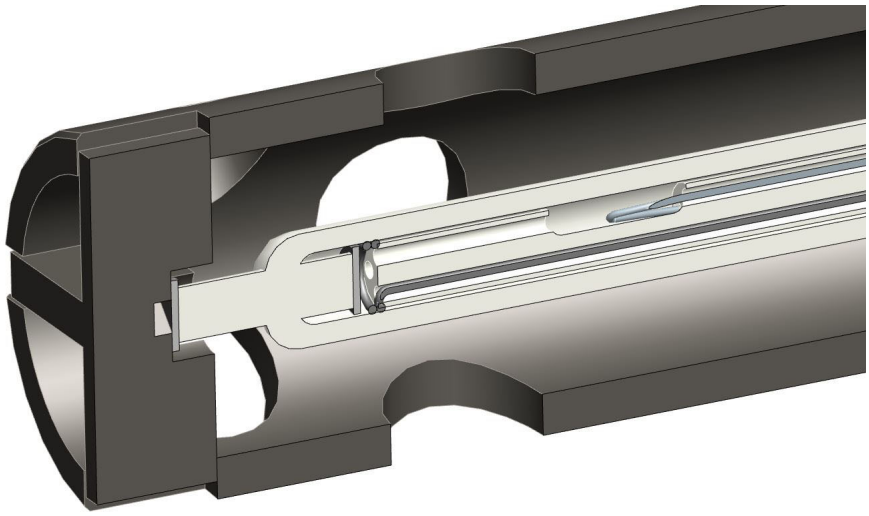

Figure 1 Carbon Probe Cross Sectional View

Unpacking

The probe must be unpacked and handled with care.

Each probe is despatched in robust packaging.

This packaging should be carefully retained. If it is required to return the probe to the supplier, then this packaging is to be used. Returning a probe in anything other than this packaging may invalidate the product warranty.

The packaging consists of an outer box and an inner plastic pack housing the probe.

Included with each probe are an Operating Manual, Test Results Certificate and a bag of fittings.

Installation

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

During commissioning, ensure all operating states and potential fault conditions are carefully tested.

Ensure correct installation.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Never connect conduit directly to the probe head because a fractured probe tube could pass furnace gases through the conduit to critical instrumentation, equipment or personnel.

The following figure shows typical probe installation.

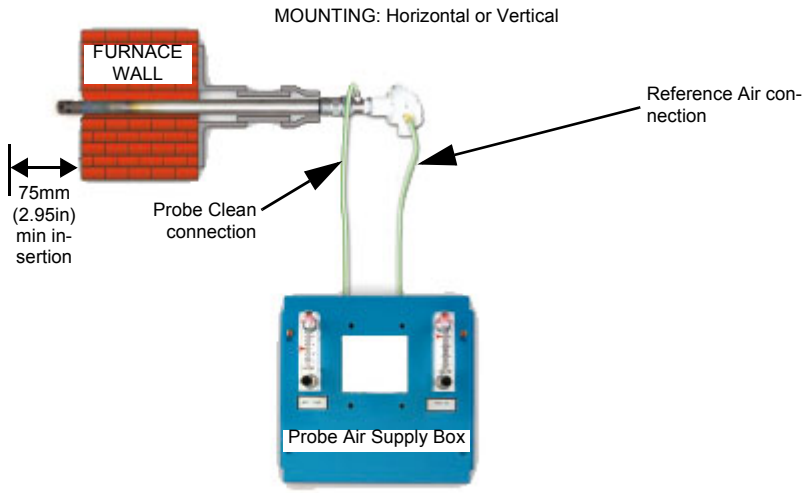

Figure 2 Probe Installation

⚠ WARNING

HOT PROBE, BURN RISK

Take care when removing a probe from a hot furnace as the probe may be extremely hot. Always use suitable Personal Protective Equipment (PPE).

Failure to follow these instructions can result in death, serious injury or equipment damage.

Mechanical

Generally, locate the probe in an area where the furnace gases are known to be thoroughly mixed. Locate in a wall area reasonably free from other pipes and valves to simplify installation and replacement.

To mount the probe, proceed as follows:

1. Probes can be mounted vertically or horizontally, vertical mounting is the preferred method. Ensure that, when mounting a probe longer than 1000mm (39in) horizontally, that it is sufficiently supported.
2. Avoid subjecting the probe to excessive vibration.
3. Locate the probe away from localized heat sources to avoid unnecessary close contact (i.e. radiant tubes, heating elements).
4. Locate the probe away from atmosphere inlets.
5. Locate the probe so that it operates in the upper area of the work zone if possible.
6. The probe access hole through the furnace lining must be 35mm (1.38in) diameter minimum.
7. Ensure center lines of the access hole and pipe couplings are concentric for correct alignment.
8. Ensure that the fixing to the furnace casing is gas-tight.

Note: The probe is supplied as standard with a 'burn-off' port. If the port is not to be used ensure that it is plugged, and the plug is fully tightened, and that thread sealant is used to obtain a gas-tight seal.

9. Install the probe so that the minimum insertion depth into the hot zone is 75mm (2.95in).

Note: If the insertion length needs to be reduced, use a suitable reduction collar or gland to decrease effective length.

⚠ CAUTION

INOPERABLE EQUIPMENT

Introduce (or remove) the probe into (or out of) a hot furnace in stages of 25mm (1in) per minute.

Do not place a hot probe on a cold surface.

Failure to follow these instructions can result in injury or equipment damage.

⚠ CAUTION

INOPERABLE EQUIPMENT

When screwing the probe in or out of the pipe fitting, use the gland nut on the carbon probe sheath.

Do not, under any circumstances, use the sensor head for tightening or loosening the probe.

Failure to follow these instructions can result in injury or equipment damage.

10. Connect reference air tubing to the reference air inlet fitting located on the probe head external surface and ensure that the probe is fed with a constant supply of reference air at 200ml per minute (0.42 SCFH) minimum.

11. It is recommended that the probe is provided with an intermittent supply of cleaning air.

Electrical Connections

Use 16/0.2mm (19/32AWG) twisted twin cable between the probe and the controller, up to a maximum length of 30m (98.4ft). If a thermocouple is included in the probe assembly, use the appropriate compensating cable. High temperature-rated (e.g. silicone rubber insulated) cable is essential for connections to the probe and over any part of the cable run which is subject to high temperatures. For the remainder of the run, shielded cable should be used. Shields should be connected to ground at the instrument end only.

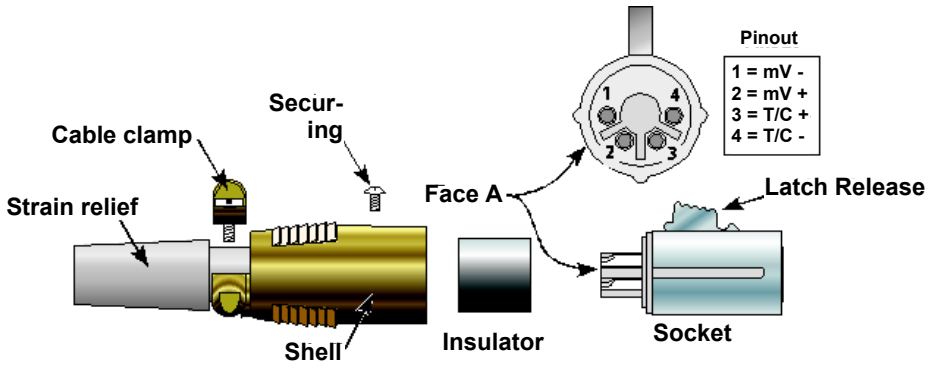

Figure 3 DIN Plug Wiring

Measuring Systems

The probe is designed to be used with a Eurotherm controller capable of carbon potential control. However, the probe may be used with any high impedance measuring system. At operating temperatures, the sensor impedance is typically 5kΩ – 50kΩ. Measuring systems with input impedances of 10MΩ or higher are recommended. If an instrument with a low impedance 'front end ' is used the effect will be to depress/lower the probe millivolt signal, resulting in inaccurate readings.

Probe Care & Maintenance

The integrity of any atmosphere control system depends on the sensor/measurement device.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not disassemble, repair or modify the equipment. Contact your supplier for repair.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Reference Air

A constant flow of Reference Air (200 - 700ml/min) (0.42 - 1.48 SCFH) is used to maintain the accuracy of the probe. Reference air should be clean and free from airborne contamination. Compressed air should not be used. If combustion air is used this should be filtered.

CHECK AND ADJUST as necessary, at least ONCE PER DAY.

Probe Cleaning

Over 80% of probe issues are due to excessive carbon build up on the probe, this is more commonly described as sooting. This can, however, be reduced by regular probe cleaning, or 'burn off', using air. The important factors affecting efficient probe burn off are:

- Furnace atmosphere pressure/velocity around the probe.
- The flow of burn off air.
- Temperature increase at the probe tip.

When air is forced down the probe sheath a combustion reaction takes place with the furnace atmosphere, this is an exothermic reaction causing a local rise in temperature. The reaction interface settles at a point down the length of the probe, see Figure 4.

As the flow of burn off air is increased the interface will naturally move down the probe. Carbon will only be removed from the probe if free oxygen is present to react with it and hence burn the carbon away. At the combustion interface oxygen will be used up quickly and there will be very little free oxygen available to react with the carbon.

The interface must therefore pass the tip of the probe in order to ensure effective cleaning at the probe tip.

If sufficient flow is present, then this combustion interface will actually move off the end of the probe entirely, leaving the probe tip in free oxygen, see Figure 5.

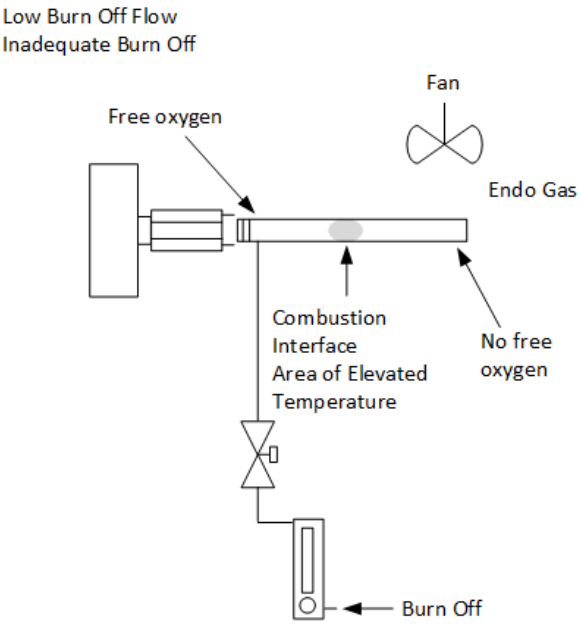

Figure 4 Inadequate Burn Off

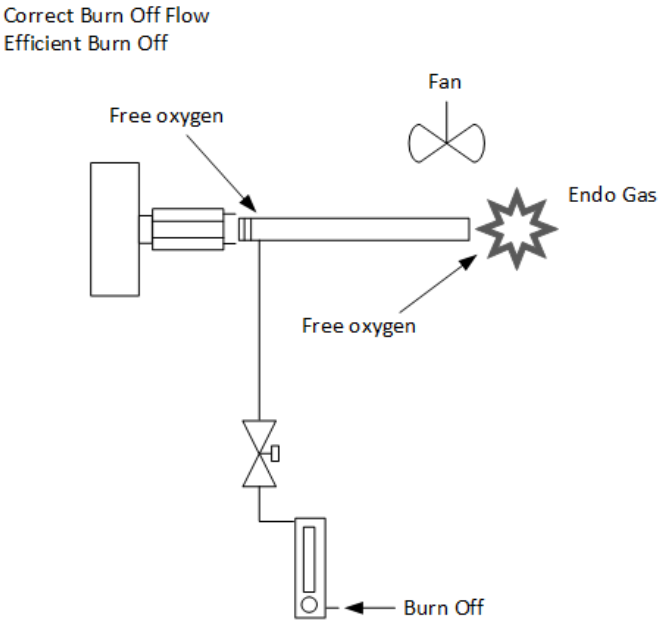

Figure 5 Efficient Burn Off

The conditions are correct when there is a significant drop in the output of the probe.

Care should be taken to avoid the combustion interface centering on the probe tip, if this is the case the probe temperature may rise by as much as 120°C (248°F). It is important to note that the probe tip must be kept below 1050°C (1922°F) to avoid permanently damaging the sensor. Therefore, it is important that the burn off flow is sufficient when probe cleaning takes place above 900°C (1652°F).

The condition of the furnace atmosphere near the probe is of great importance when establishing the correct flow rate. For example, in one installation a flow of 4000ml/min (8.48 SCFH) was required to overcome the atmosphere but only 1000ml/min (2.12 SCFH) was required when the furnace fan was switched off.

Probe cleaning normally takes between 3 and 6 minutes. It is best carried out at the start of a cycle to ensure correct operation during the process and may be repeated during long cycles (or periodically in a continuous furnace) to maintain the level of atmosphere control.

Most carbon controllers have inbuilt facilities to activate the probe cleaning air automatically during the cycle. Alternatively, a timer can be built into the probe air supply cabinet.

⚠ CAUTION

INOPERABLE EQUIPMENT

Inadequate or incorrect probe air cleaning may lead to incorrect readings.

CHECK AND ADJUST as necessary, at least ONCE PER DAY.

Failure to follow these instructions can result in injury or equipment damage.

Diagnostic Testing

The only way to establish that the probe is reading accurately is to compare the reading with a reference probe, carbon foil, or another gas parameter i.e. CO2 or DEWPOINT.

The following tests can be performed to give an indication of the probe health.

Electrical Impedance Test

The output impedance of a probe is a function of the electrode contact area, materials of construction, and temperature. The lower the impedance, the more surface area is in contact with the electrode assembly. A value below 25kΩ at temperature above 800°C (1472°F) is acceptable, once the value rises above 50kΩ it is necessary to change the probe.

CHECK AND RECORD the probe impedance on a WEEKLY basis.

Electrode Response Time

The ability of a probe to recover to its original millivolt reading, after being short circuited, is an important parameter.

To run a test, it is necessary to short circuit the probe electrodes for 15 seconds, remove the short, and measure the time for the millivolt reading to recover to 99% of its original value. If this time is more than 60 seconds, the probe is behaving sluggishly and its health or performance may be compromised.

Troubleshooting

Instrument and Voltmeter tests

Check/perform the following:

- Probe thermocouple display on measurement instrument is within ±10°C (18°F) of furnace control thermocouple.
- Process Factor, ‘CO Factor’, or, oxygen probe mV offset is set to the appropriate value.
- Oxygen mV reading on the instrument matches a simultaneous reading from digital voltmeter within ±6mV.

Note: Digital voltmeter to be 0.5% basic DC accuracy with 10MΩ minimum input impedance, or higher in both cases.

- After the probe is shorted for 15 seconds, it returns to its original reading, ±10mV, within 60 seconds (as measured with the voltmeter).

Reference Air Tests

Perform the following:

- Reference air consists of clean room air, free of airborne contaminants (not compressed air). Try alternative sources of reference air if in doubt.
- Reference air flow is between 200 and 700ml/min (0.42 - 1.48 SCFH) on the flowmeter. The reference air tube can be disconnected at the probe and should bubble when placed in a cup of water (i.e. reference air is getting to the probe).
- With instrument in manual control mode, shutting off the reference air for 30 seconds should not result in the loss of more than 5mV on the O2 mV display.

Impedance Test

With the probe at 800°C (1472°F) minimum, the probe impedance test yields values in the range of 0.1Ω to 50kΩ. Typical readings for the carbon probe will be 5Ω to 10kΩ.

Visual Observation

⚠ WARNING

HOT PROBE, BURN RISK

Take care when removing a probe from a hot furnace as the probe may be extremely hot. Always use suitable Personal Protective Equipment (PPE).

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

INOPERABLE EQUIPMENT

Introduce (or remove) the probe into (or out of) a hot furnace in stages of 25mm (1in) per minute.

Do not place a hot probe on a cold surface.

Failure to follow these instructions can result in injury or equipment damage.

Observe and verify the following:

- Probe/Sheath shows no accumulation of soot or other deposits (any accumulation may mean that the burn off procedure is ineffective).
- Probe sensor tip, as viewed through the sheath holes, shows no obvious fracture and the sensor appears physically intact.
- Probe sheath/head box shows no signs of mechanical damage.

Appendix A - Reference Tables

% Carbon vs. mV Reference Tables

The following tables give %CP vs. probe millivolts at different furnace temperatures for a natural gas (20% CO) and propane (23% CO) reacted endothermic carrier gas.

These tables are based on theoretical calculations and are for EQUILIBRIUM conditions only.

Note: For most heat treatment operations, equilibrium conditions rarely exist.

Table 1: Relationship Between %CP and Probe mV at Various Temperatures for Endothermic Atmospheres Generated from Methane (20% CO)

	Temperature °F/°C								
	1472°F	1517°F	1562°F	1607°F	1652°F	1697°F	1742°F	1787°F	1832°F
% CP	800°C	825°C	850°C	875°C	900°C	925°C	950°C	975°C	1000°C
0.20	1034	1039	1043	1048	1053	1058	1062	1067	1072
0.25	1043	1048	1053	1058	1063	1068	1073	1078	1083
0.30	1051	1056	1061	1066	1072	1077	1082	1087	1092
0.35	1058	1063	1069	1074	1079	1085	1090	1095	1101
0.40	1065	1070	1076	1081	1087	1092	1098	1103	1109
0.45	1071	1076	1082	1088	1093	1099	1105	1110	1116
0.50	1076	1082	1088	1094	1100	1105	1111	1117	1123
0.55	1082	1088	1094	1099	1105	1111	1117	1123	1129
0.60	1087	1093	1099	1105	1111	1117	1123	1129	1135
0.65	1091	1097	1103	1110	1116	1122	1128	1134	1140
0.70	1096	1102	1108	1114	1120	1127	1133	1139	1145
0.75	1100	1106	1112	1119	1125	1131	1138	1144	1150
0.80	1104	1110	1116	1123	1129	1136	1142	1148	1155
0.85	1107	1114	1120	1127	1133	1140	1146	1153	1159
0.90	1111	1117	1124	1131	1137	1144	1150	1157	1163
0.95	1114	1121	1128	1134	1141	1148	1154	1161	1167
1.00	1118	1124	1131	1138	1144	1151	1158	1165	1171
1.05	1121	1127	1134	1141	1148	1155	1161	1168	1175
1.10	1124	1131	1137	1144	1151	1158	1165	1172	1179
1.15	1127	1133	1140	1147	1154	1161	1168	1175	1182
1.20	1129	1136	1143	1150	1157	1164	1171	1178	1185

Table 2: Relationship Between %CP and Probe mV at Various Temperatures for Endothermic Atmospheres Generated from Propane (23% CO)

	Temperature °F/°C								
	1472°F	1517°F	1562°F	1607°F	1652°F	1697°F	1742°F	1787°F	1832°F
% CP	800°C	825°C	850°C	875°C	900°C	925°C	950°C	975°C	1000°C
0.20	1027	1031	1036	1041	1046	1051	1055	1060	1065
0.25	1036	1041	1046	1051	1056	1061	1066	1071	1075
0.30	1044	1049	1054	1059	1064	1070	1075	1080	1085
0.35	1051	1056	1062	1067	1072	1078	1083	1088	1094
0.40	1058	1063	1069	1074	1080	1085	1091	1096	1101
0.45	1064	1069	1075	1081	1086	1092	1097	1103	1109
0.50	1069	1075	1081	1087	1092	1098	1104	1110	1115
0.55	1075	1081	1086	1092	1098	1104	1110	1116	1122
0.60	1080	1086	1092	1098	1104	1110	1116	1122	1127
0.65	1084	1090	1096	1102	1109	1115	1121	1127	1133
0.70	1089	1095	1101	1107	1113	1120	1126	1132	1138
0.75	1093	1099	1105	1112	1118	1124	1130	1137	1143
0.80	1097	1103	1109	1116	1122	1128	1135	1141	1148
0.85	1100	1107	1113	1120	1126	1133	1139	1146	1152
0.90	1104	1110	1117	1123	1130	1137	1143	1150	1156
0.95	1107	1114	1120	1127	1134	1140	1147	1154	1160
1.00	1110	1117	1124	1131	1137	1144	1151	1157	1164
1.05	1114	1120	1127	1134	1141	1147	1154	1161	1168
1.10	1117	1123	1130	1137	1144	1151	1158	1165	1171
1.15	1119	1126	1133	1140	1147	1154	1161	1168	1175
1.20	1122	1129	1136	1143	1150	1157	1164	1171	1178

Appendix B - Specification

Dimensions

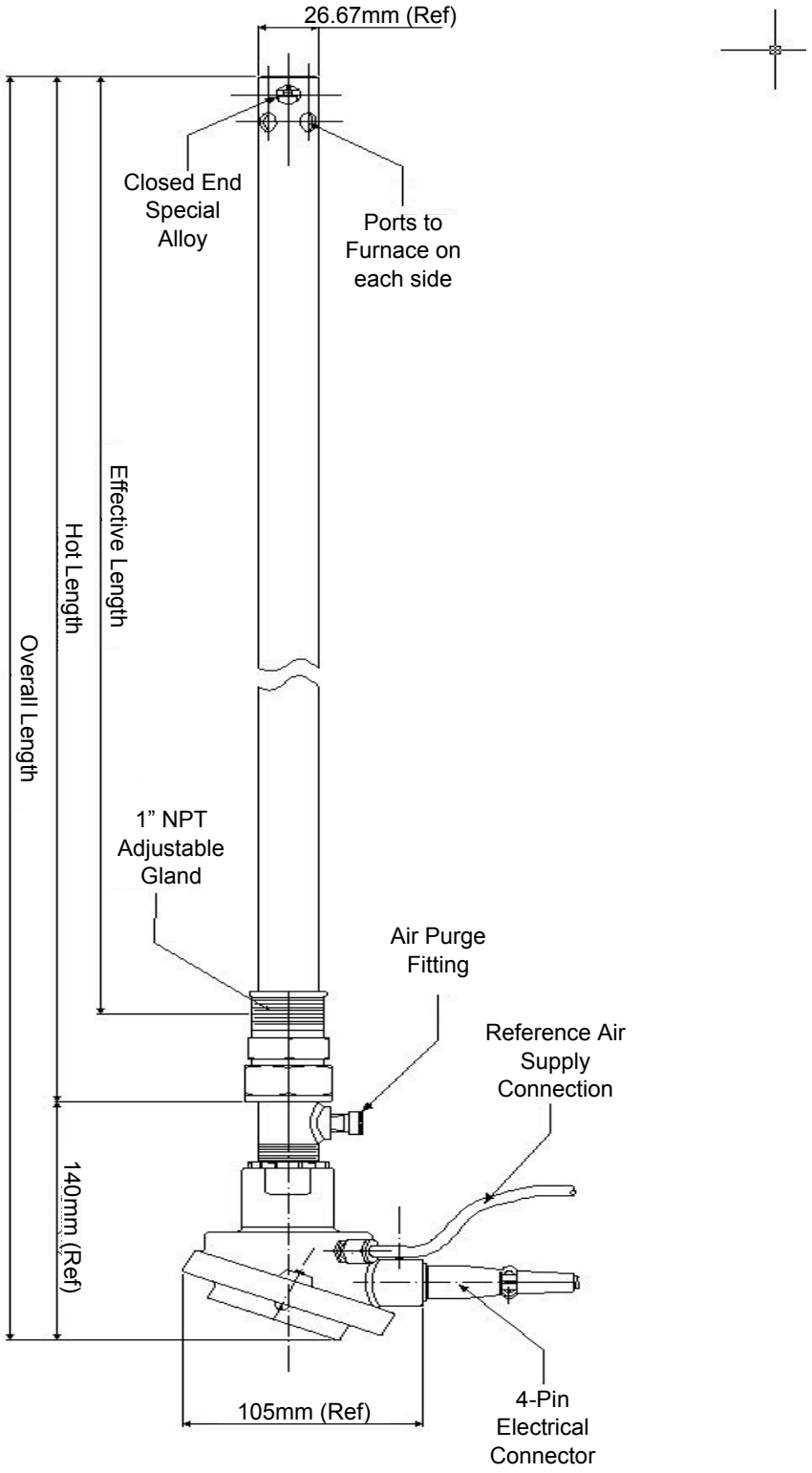

Figure 6 Probe Dimensions

Technical Specifications

Table 3: Probe Sizes and Lengths (±10mm)

Probe Size	Effective Length mm (inches)	Hot Length mm (inches)	Overall Length mm (inches)
APxx-xx121	462 (18.2)	513 (20.2)	653 (25.7)
APxx-xx124	539 (21.2)	590 (23.2)	730 (28.7)
APxx-xx128	640 (25.2)	691 (27.2)	831 (32.7)
APxx-xx132	742 (29.2)	793 (31.2)	933 (36.7)
APxx-xx136	844 (33.2)	895 (35.2)	1035 (40.7)
APxx-xx144	1049 (41.3)	1100 (43.3)	1240 (48.8)

Table 4: Other Parameters

Parameter	Value
Output:	0.00V to 1.40V dc over operating range.
Temperature range:	760°C to 1050°C (1400°F to 1922°F)
10-90% Response time:	Less than 2s at temperatures $\geq$ 760°C
Range of operation:	Partial pressure of oxygen down to 10^{-24}.
Thermocouple:	Types K, R, S, N and No T/C
Probe sheath:	Special alloy – resistant to corrosion and oxidization up to 1050°C (1922°F)
Diameter of sheath:	26.67mm (1.05in) O.D. nominal
Aperture required:	35mm (1.38in) minimum
Fitting detail:	Screwed fitting 1 inch NPT Male Adjustable Gland
Minimum Furnace insertion:	75mm (2.95in)
Reference Air Flow:	200ml/min (0.42 SCFH) to 700ml/min (1.48 SCFH) air (20.9% O_2)
DC Measuring System:	%Oxygen sensors should be used with a controlling, recording, or indicating instrument having an input impedance of 10MΩ or higher.

Appendix C - Part Numbers

The following Part Numbers apply to the AP1 Carbon Probe:

Table 5: Part Numbers

Part Number	Description
AP10-00121	AP10 STANDARD 21
AP10-00124	AP10 STANDARD 24
AP10-00128	AP10 STANDARD 28
AP10-00136	AP10 STANDARD 36
AP11-00121	CAR PROBE PS TYPE K 21
AP11-00124	CAR PROBE PS TYPE K 24
AP11-00128	CAR PROBE PS TYPE K 28
AP11-00132	CAR PROBE PS TYPE K 32
AP11-00136	CAR PROBE PS TYPE K 36
AP12-00121	CAR PROBE PS TYPE R 21
AP12-00132	CAR PROBE PS TYPE R 32
AP13-00121	CAR PROBE PS TYPE S 21
AP13-00124	CAR PROBE PS TYPE S 24
AP13-00128	CAR PROBE PS TYPE S 28
AP13-00132	CAR PROBE PS TYPE S 32
AP13-00136	CAR PROBE PS TYPE S 36
AP13-00144	CAR PROBE PS TYPE S 44
AP15-00128	CAR PROBE PS TYPE N 28
AP17-00144	TYPE S T/COUPLE FOR 44" PROBE 30 GAUGE

Table 6: Other Parts

Part Number	Description
LA031108	LENGTH REDUCTION COLLAR CARBON PROBE
E24-540	SOCKET CONNECTOR
A10727-200-06	KTYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-200-12	K TYPE 4 COND W/ARMOUR 12' PROBE CABLE
A10727-200-18	K TYPE 4 COND W/ARMOUR 18' PROBE CABLE
A10727-300-06	R & S TYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-300-12	R & S TYPE 4 COND W/ARMOUR 12' PROBE CAB
A10727-300-18	R & S TYPE 4 COND W/ARMOUR 18' PROBE CAB
A10727-500-06	N TYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-500-12	N TYPE 4 COND W/ARMOUR 12' PROBE CABLE
A10727-500-18	N TYPE 4 COND W/ARMOUR 18' PROBE CABLE
A12337-200-06	K TYPE 4 CONDUCTOR 6' PROBE CABLE
A12337-200-12	K TYPE 4 CONDUCTOR 12' PROBE CABLE
A12337-200-18	K TYPE 4 CONDUCTOR 18' PROBE CABLE
A12337-300-06	R & S TYPE 4 CONDUCTOR 6 PROBE CABLE
A12337-300-12	R & S TYPE 4 CONDUCTOR 12' PROBE CABLE
A12337-300-18	R & S TYPE 4 CONDUCTOR 18' PROBE CABLE
A12337-500-06	N TYPE 4 CONDUCTOR 6' PROBE CABLE
A12337-500-12	N TYPE 4 CONDUCTOR 12' PROBE CABLE
A12337-500-18	N TYPE 4 CONDUCTOR 18' PROBE CABLE

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As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

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