tyco / Flow Control / Environmental Systems

USER MANUAL v1.6

EMS6 Emission Monitor

Safety

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Document Ems6Um16, Issued 30 October 2000. Reference Products: EMS6 v1.76, 1.77, 1.78, Connect v2.14, 3.0.

SAFETY

Electrical

EMS6 operates from low voltage DC power supplies which pose no danger or health risk.

Process

This equipment may be connected to plant which operates at high temperatures or pressures, or with harmful materials. Before any installation or maintenance work is carried out, please ensure that the proper isolations have been performed.

INTRODUCTION

This manual contains information relevant to the installation, commissioning and initial operation of the EMS6 Emission Monitor. EMS6 and this manual are subject to continuous development, and it is acknowledged that the manual may contain errors and/or omissions. For the most up-to-date information, including applications information, the user should always refer to the supplier.

Description

General

EMS6 is designed to detect and report solid particulate matter in motion. It consists of a cylindrical electronics housing and a separately attached sensing element (rod or wire). When the housing is mounted in the side of a duct carrying moving dust particles, the sensing element is exposed to the particles. The particles are usually suspended in a gas stream which is exhausted to atmosphere, but the particles may alternatively be conveyed by other means, even gravity-fed.

All dust particles naturally accumulate triboelectric charge, and EMS6 is designed to detect the magintude and characteristics of that charge, thereby providing an indication of the total dust flow rate.

Interconnection

Unlike traditional triboelectric emission monitors, EMS6 has no analog or relay output signal. Instead, EMS6 is connected to a CONNECT network cable, becoming one of up to 29 parallel devices per network. Each device on the CONNECT network is configured and polled in rotation by the CONNECT software, which acts either as a stand-alone data acquisition and presentation system, or as a front end to a third party SCADA system, providing dynamic data via a standard DDE interface. Alternatively, a SCADA system or PLC can be set up to independently poll EMS6 using the widely supported Modbus network protocol. Regardless of the method chosen, a variety of alarm and other functions will be configurable to suit the user.

SPECIFICATIONS

Certifications

Directives:	89/336/EEC, 93/68/EEC, 73/23/EEC, AMD93/68/EEC
Standards:	EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6, ENV 50204 AS/NZS2064: 1997 (CISPR11), AS/NZS 2064: 1997 EN50082-2: 1995, EN60950: 1992, AMD3 95, BS EN 55 081-1 GENERIC EMISSION STANDARD PART 1, BS EN 50 052-1: 1992 GENERAL IMMUNITY STANDARD PART 1
CE	This symbol indicates compliance with the EMC directive and the Low Voltage directive (LVD).
C-tick	This symbol indicates compliance with Australian / New Zealand C-tick EMC standards for emission.

Operational Limits

Ambient Temperature	-20C to 60C (for electronics)
Vibration	1G (10m/s2) RMS max continuous, any direction, any frequency (with short or separately supported wire rope probe).
Environment	IP66/NEMA4, non-corrosive (Aluminium alloy body, stainless steel inserted parts)
Duct Gas Pressure	100kPa (15 PSI) max
Duct Gas Temperature	-20C to 80C or 200C max (standard models; higher temp to order)
Purge Air Pressure	400kPa (60 PSI) max

Standard Conditions

Duct Gas Velocity	5m/s to 30m/s (virtually unlimited with appropriate probe installation).
Particle Size	0.1um to 1000um (still functional outside nominal range with slightly different characteristics)
Duct Size	50mm to 10m diameter (using the appropriate probe options)
Humidity	0 to 80% non-condensing
Magnetic Field	60A/m max at 50Hz (= 50Ampere-Turns in a 1m X 1m square coil)

Mechanical

Purge Air	RC 1/8" purge air connection point is provided. Periodically pulsed purge air is useful to prevent particulate buildup.
Probe	Removable M8 thread fitting. 300 x 5mm stainless steel wire rope is standard. Probe length and type in accordance with installation requirements.
Probe Options	Solid rod, tubular, extendable, PTFE coated, tubular ceramic, wear-resistant alloys, multiple supports, any length.
Dimensions	88 dia X 125 long (+18 cable gland, +70 probe mount nose).
Mounting	1" male BSPT requires 1" female pipe fitting on duct (optional quick disconnect)

Electrical

Power supply	8-15VDC +/-15% regulated via network cable: <10mA (normal), <100mA (transmitting)
Connection	4 core screened cable for power (+ and -), RS485 network (+ and -), Drain

Emission Signal

Range	100dB, using 64:1 programmable gain range, and 14 bit linear analog to digital converter (0 to 16383).
Resolution	Typically 0.002mg/m3 at max gain
Zero Drift	Better than 0.3% of range per year. Better than 0.3% of range over specified Temperature range.
Gain Drift	Better than 1% of range per year. Better than 1% of range over specified Temperature range.
Circuit Linearity	Better than 1% of range.
Circuit Stability	Only high stability components are used (no trimpots).
Noise Immunity	All 50Hz or 60Hz and harmonics are effectively removed from the signal before detection. However proper grounding and shielding techniques must be used to avoid mains frequency interference overloading the first amplifier.
Gain Switch	High (0-20mg/m3), Med (0-150mg/m3), Low (0-1000mg/m3) (nominal only: depends on material, velocity, geometry)

Network

Network Physical	RS485 multidrop at 9600b/s, 1startBit, 2 StopBits, HalfDuplex, lsb first, max 30 nodes, >=3.5 character gap between all packets
Network ID	By switch: Tens (0-2) and Units (0-9). By remote software: 1-255. 0 is not permitted, and will be ignored
Poll (Scan) Interval	100ms minimum, no maximum (internal time constants approx 250ms)
Network Protocol	Modbus RTU compatible (query packet contains NetworkID, FunctionCode, Address, Data, CRC, then a delay >= 3.5 characters)
Network Function Codes	03h - Read 4x Registers (eg the 16bit Emission at 40006 (0005)) 04h - Read 3x Input Registers (must be raw Emission Level 30001 (0000)) 06h - Write 4x Register 10h - Write Multiple 4x Registers
Normal Poll/Response	NetworkID 03 00 05 00 01 CrcL CrcH NetworkID 03 02 DataH DataL CrcL CrcH
SCADA Settings	Init with "Read Holding Register" (Function code 3). Also suggest Timeout = 50ms, Retries = 0, Max block read = 32 registers or 500 bits (coils).

Diagnostics

Self-Test	On power-up, EMS6 enters "EDS" mode, in which an "Electronic Dust Signature" signal is generated and fed to the amplification circuitry instead of the probe signal. This signature signal will be read for the first 50 polls, after which the normal probe signal will be read. This initial EDS signal can be ignored by the master, or checked to verify that no drift has occurred. Under PLC or SCADA control, or under CONNECT 2.20 or later, other parametric tests can be initiated on demand, including EDS and internal power supply voltages.

FEATURES

Low Noise

EMS6 is an integrated probe and digital monitor, avoiding the inevitable noise, signal loss, linearity loss and microphonics of a passive probe with separate electronics. EMS6 combines the most effective current technologies.

Easy Probe Mounting

Probes mount onto monitors via a standard M8 thread, and so can be replaced easily if damaged, or to adjust coverage.

Probe Options

Standard probes are 5mm dia stainless steel wire rope, but many variants are available to suit different applications, including various lengths of plain wire rope, rigid rod and telescopic tube, plus special coatings including PTFE, custom wire rope arrays and custom probe materials such as Tungsten Carbide.

Hostile Environments

Robust machined alloy housing, with inserted parts of stainless steel, and purge air facilities to clear particulate buildup from the probe and insulators in hostile environments.

Open architecture

With a simple industry-standard Modbus RTU ™ compatible communications protocol, the user can purchase emission monitors only, and easily interface them to either a ModiconTM or other compatible PLC, or any central SCADA system. ModbusTM documentation, support and expertise are plentiful, so customers will not feel isolated.

Low Power

Up to 29 EMS6s can be connected to and powered from a single "daisy chained" network, covering up to 1km, making wiring easy. There is no need for separate power supply for each EMS6. There is no limit to the number of networks.

Remote Setup

While NetworkID and Gain can be set up locally via selector switches, those and all other parameters can be set up remotely via the network. There is no need for ongoing access to the instrument, so commissioning and maintenance are easy. EMS6 can also respond to changes to Network ID and Gain via the network if required.

Long Service Life

Design service life exceeding 20 years. Our earliest triboelectric emission monitors have been in continuous operation since 1992.

Complete Family

EMS6 is part of a complete family of products for the clean air industry from monitors to control computer systems and turnkey projects.

Appendix D
Emission Monitor Deployment

Introduction

Preparation

Illustrations

Wiring

Alarms

Purging and Cleaning

INTRODUCTION

This document details the recommended steps in installing a Triboelectric Emission Monitor to ensure that it performs well. This document and the product manuals are all subject to continuous development, and it is acknowledged that they may contain errors and/or omissions. For the most up-to-date information, including further applications information and case studies, the user should always refer to the supplier, or to the latest issue of CONNECT, whose HELP system will also include this document.

PREPARATION

Mounting Positions

Choose a mounting position which satisfies these criteria:

- in a straight section of metal duct,
- at least 5 diameters after or 2 diameters before any bend or screen,
- about 2 diameters before any isokinetic sampling point, at right angles,
- even further from dampers, electrostatic precipitators, wet scrubbers, fans,
- away from high vibration, ambient temperature or direct radiation,
- with probe axis perpendicular to the gas flow,
- with probe axis perpendicular to the plane of the nearest bend (if close).

Control Units, Juction Boxes and Numeric Displays (eg EMP5, ANJ1 and AUD1) should be mounted in a safe position which provides easy access and operability, but close to their connected Emission Monitor or Active Head.

Grounding Of The Duct Material

If possible, replace any insulating material (particularly plastic) which comes into contact with the gas flow, with grounded metal.

Ensure that every part of the duct and all metal exposed to the gas flow (eg inspection covers, fan and damper blades, isokinetic probes) are grounded.

If there remain any ungrounded metal or insulating material in contact with the gas stream, ensure that it is electrically screened from the probe (eg, by an intermediate grounded welded mesh screen). For any unusual conditions, consult the supplier.

Probe Options

The Emission Monitor is widely adjustable, however probe length also has a significant effect on sensitivity, so choose the probe length according to these recommendations:

- Below 1mg/m3: 0.8 duct diameters
- Above 100mg/m3: 0.1 duct diameters
- Otherwise: 0.5 duct diameters

Probes are traditionally formed from solid stainless steel rod. However stainless steel wire rope is standard for new models, and is available on request for all other models. Wire rope has a number of advantages over solid rod:

- The surface texture and small diameter minimise downstream gas flow disturbances to flow transmitters, isokinetic sampling probes, etc,
- The high internal damping eliminates resonance effects which can damage probes and Emission Monitors,
- The inherent sagging minimises the probability of a probe unscrewing itself in operation.
- The wire strands slide slightly against each other with normal movement of the probe in the gas stream, which tends to dislodge accumulated matter.

Standard wire rope probes are commonly fitted in one of these forms:

- Cantilevered probe 0-800mm: use a simple wire rope probe alone.
- Probe 800-2000mm total: supported on opposite side by P2-60230 support head.
- Probe above 2000: string the probe across the duct with egg insulators in line at both ends, and strong supports. Add another short section of stainless steel wire to connect the Emission Monitor to the probe.

Since emission monitors are rated for an insertion temperature of 200C max, elevated temperatures require the use of extension tube mounting kit such as P2-60205 (300mm, up to 500C) or P2-60210 (450mm, up to 600C). Provided the gas path is at negative pressure and non-toxic (the usual case for a stack), and the emission monitor body is protected from rain or other contaminants, improved cooling for the emission monitor may be provided by drilling several holes around the outermost end of the mounting tube, thus allowing ambient air to coat the emission monitor's nose and part of the probe.

Alternatively, consult the supplier to discuss other probe options including:

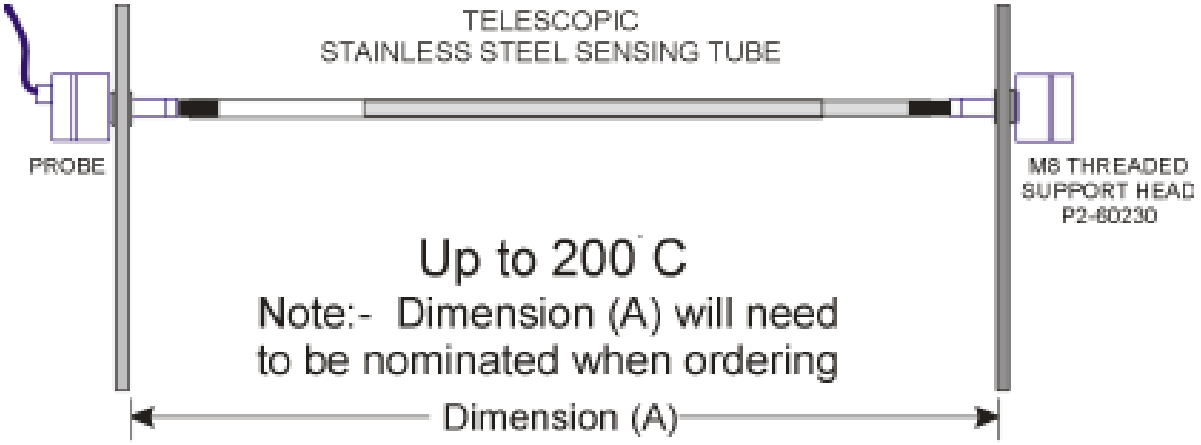
- rigid rod,
- PTFE coated rod,
- rod or rope in wear-resistant material,
- telescopic tubes, as follows:
  - Probe 800-1100mm: use P2-90600 telescopic + P2-60230 support head.
  - Probe 1100-1700mm: use P2-90610 telescopic + P2-60230 support head.
  - Probe 1700-2500mm: use P2-90620 telescopic + P2-60230 support head.

Other Options

If the insertion temperature is over 80C, check with the supplier to ensure that the equipment, accessories and mounting arrangement are suitably rated.

If a quick-release tapping point is required, use either the Bolt-on Mount Kit (P/No. P2-60203, fig 1) or the Weld-on Mount Kit (P/No. P2-60202, fig 2 and fig 4).

ILLUSTRATIONS



AVAILABLE LENGTHS AND PART NUMBERS

P2-90600 Dimension (A) from 700 - 1100mm
P2-90610 Dimension (A) from 1100 - 1700mm
P2-90620 Dimension (A) from 1700 - 2500mm

Installation

Cut a 30mm hole in the duct, and either:

- Weld on a plain 1 inch BSPT female bush, or
- Weld on the Weld-on Mount Kit (P/No. P2-60202, fig 2 and fig 4), or
- Weld on a flange to suit Bolt-on Mount Kit (P/No. P2-60203, fig 1).

If a mount kit is used, screw the Emission Monitor or active head firmly into the thread insert with chamfer outwards (fig 3), insert the assembly through the mounting flange, apply thread sealant to the grub screws and tighten them (fig 5). Otherwise, install the Emission Monitor (firmly hand-tighten) directly in the BSPT bush on the duct.

Figure 1

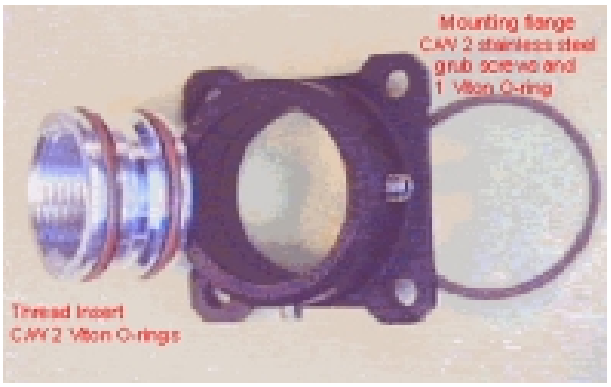


Figure 2

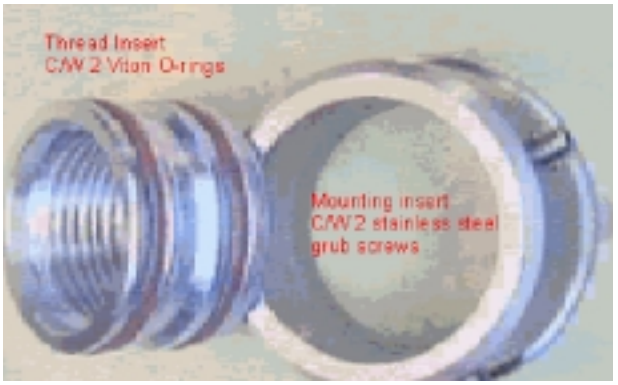


Figure 3

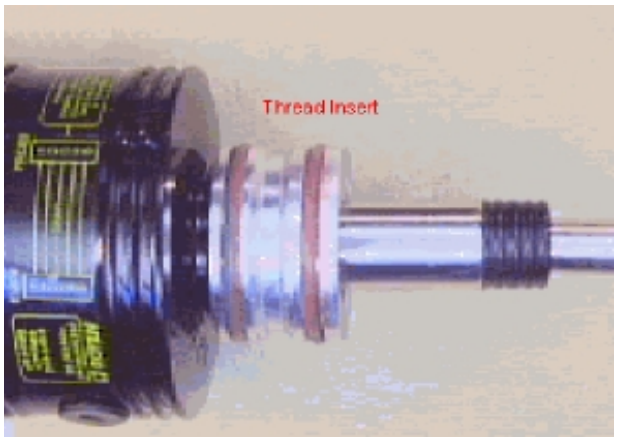
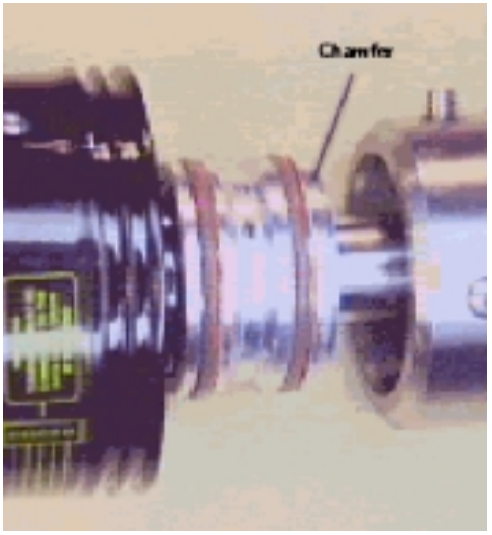


Figure 4

Figure 5



WIRING

Wiring may only be undertaken by a qualified and licensed practitioner, and must be performed in full accordance with all local regulations. After all connections are made, ensure that the electrical gland is tight to maintain IP ratings.

Remove the lid of the Emission Monitor or Active Head and feed the screened data cable through the lid gland. Clamp the gland onto the cable, lock the outer screen (drain) wire under the lid's internal earth screw if fitted, terminate all cores to the pluggable terminal strip, plug in the terminal strip and replace the lid.

The standard wiring colour code for Networked Emission Monitors and Active Heads is:

Product	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5
Networked Emission Monitor	White	Green	Screen	Black	Red
Active Head	Green	White	Screen	Red	Black

ALARMS

High Alarms

A basic emision monitoring system will include at least one alarm to indicate that emissions have increased to an unacceptable level. If only one alarm is available, it should be set to about 2 to 3 times the normal running level, or as decreed by the EPA. The alarm delay should be set to at least as long as any normal system disturbances (eg, cleaning pulses from a bag filter), so that the alarm only responds to genuine high emission levels.

Low Alarms

The emission signal can drop below normal because of an obstructed filter or because of particulate buildup across the insulators on the emission monitor. If a Low Alarm is available, it may be set up safely below normal emission levels to warn of these conditions, so that corrective action can be taken.

Software Alarms

Software alarms should be directed to the appropriate output device so that the operator is aware of the alarm condition (in the CONNECT software, the alarm is displayed on-screen, and it is usual also to direct each alarm to an external relay and/or an internal computer-generated audible signal). For bag filter installations there are also a number of options for Row Leak Discrimination.

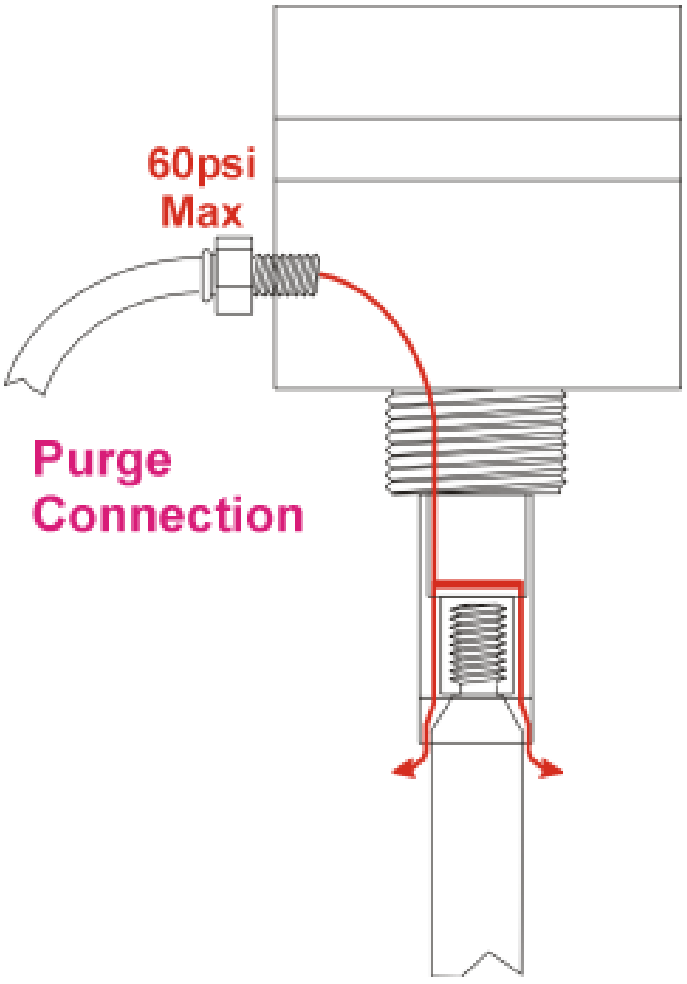
PURGING AND CLEANING

Particulate Buildup

Particulate buildup on the probe itself can be minimised by the use of PTFE coated probes (consult the supplier), however buildup on the probe will not cause errors in any case. Buildup across the insulation barrier from the probe to the earthed metalware will, however, progressively attenuate the emission signal, so it should be avoided where possible. A low level alarm can be configured to detect this condition.

Connecting The Purge Air

The purge air port may be connected to a source of clean dry instrument air. If particulate buildup is considered to be a potential problem, then a periodic pulse of purge air (not a continuous bleed) will dislodge recently deposited particles. NEVER exceed the rated pressure of the purge port, or overtighten the air fitting. If not using this facility, the original sealing plug and O-ring must be fitted at all times.



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Corrosive Gases

If the gas is corrosive, it should not be allowed to enter the body of the Emission Monitor; normally the purge air path is sealed off in these circumstances by a plug inserted before the probe is screwed in (see the supplier). This is the recommended method. If, however, purge air is required with a corrosive gas, then the purge path cannot be sealed, and a small amount of continuous purge air should be allowed to flow in addition to the pulsed purge air, to prevent the corrosive gas entering the housing.

Periodic Cleaning

Normally, no periodic maintenance is required. If purge air is not used, or in extreme cases even when it is used, it may be desirable to periodically remove, inspect and clean the inserted parts of the Emission Monitor, and also any other insulators if used to support the probe. The period of this maintenance may vary from weekly to annually, depending on the material characteristics.