

TOTAL PRECIPITATION COLLECTOR MODEL TPC-3000

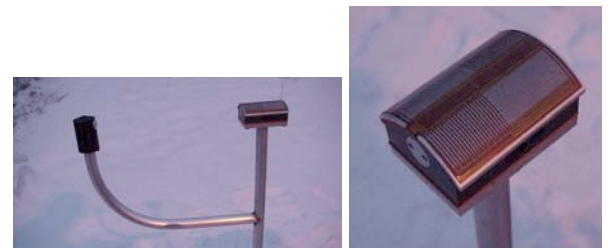
BULLETIN TPC-3000



TPC-3000 shown on optional stand

OptiGrid™ Optical + Grid Sensor

The TPC-3000's precipitation sensor uses a sophisticated multi-parameter sensing technology that sets it apart from all other precipitation collectors in terms of reliability and repeatability. A dual beam, IR optical sensor uses synchronous detection to detect snow, freezing and light rain precipitation. A second, heated dual grid impedance sensor detects light precipitation events and filters out insect interference by qualifying the optical sensor output during warmer weather. A carefully optimized decision algorithm running on the embedded system processor reliably controls lid operation based on real time sensor data.



Multi mode intelligent precipitation OptiGrid™ sensor uses optical and impedance sensing

$$p = \frac{\rho RT}{m}$$

$$S(\lambda) = S_0(\lambda) e^{-m \cdot \delta(\lambda)}$$

$$B(T) = bT^4$$

$$e_w(T_d) = \frac{r}{0.62197 + r} p$$

$$2\Omega v \sin \phi = 2\Omega w \sin \phi + F_x$$

$$\frac{du}{dt} = \frac{uv \tan \phi}{a} - \frac{1}{\rho} \frac{\partial p}{\partial x}$$

General Description

Designed for fully automatic remote operation, the Model TPC-3000 Total Precipitation Collector consists of a collection vessel, a motor-operated lid and a precipitation sensor. The collection vessel is normally kept covered by the lid during periods of non-precipitation. The user periodically visits the system to recover the precipitation sample for off site lab analysis. A next-generation, CPU-managed precipitation sensor produces the open/closed decision that controls the motor-gearbox assembly.

Often the very earliest phases of a precipitation event contain the highest concentration of pollutants as the atmosphere is flushed. A historical lack of sensitivity has generally created a low bias, underreporting pollution levels. The OptiGrid™ precipitation sensor represents a major improvement over older technology where early very light precipitation was simply not collected.

An Infrared Data Association® (IrDA) data port permits interaction with the system to view recent operational event history via a user-supplied Palm handheld device. The TPC-3000 is also expandable, accommodating additional slave systems supporting multiple chemical assays.

Features

- State-of-the-art completely automated precipitation detection and collection
- Supports MS-Windows and Palm™ devices
- Event logs enable QC management of large geographically-distributed collector networks
- Modular design is lightweight and portable
- Integrates with a variety of low cost rain gauges
- Compatible with legacy sampler mounts
- AC line or DC battery operation (solar option)

Applications

- Atmospheric wet deposition at remote sites
- Acid rain and global climate change research
- Dispersion modeling, QC of plume puff models
- Pesticide and chemical/Bio agent research
- Mercury monitoring



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Distributed Data Collection

Managing a network of precipitation collectors represents a formidable data management and quality control task. Network operations are greatly simplified via field data management tools provided with each system. Collector and co-located tipping bucket rain gauge data are collected via direct RS-232 cable and user-supplied laptop PC; via user-supplied GSM or V.90 dialup telephone modem; or via a user-supplied IrDA-equipped Palm™ handheld device.



TPC-3000 with lid closed



TPC-3000 with lid open

System Management

In addition to supporting connections to data loggers PLC and serial devices, you can view data at the site via your user-supplied Palm handheld device, or Windows laptop PC.

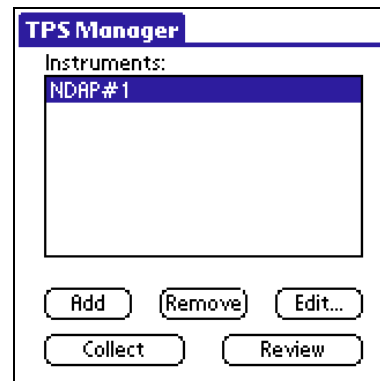
You choose the management platform. With their ample data storage and Palm handheld devices reduce the need for more expensive and far more fragile laptops. Multiple interfaces provide flexibility today and into the future.

Periodic maintenance includes inspecting and cleaning the precipitation sensor, checking the standby battery electrolyte level and looking at event data. In addition to precipitation events, logs include system jam conditions and power cycling. Once synchronized with the Palm Desktop, ASCII event data files can be ingested into your downstream database, enabling near-online quality control and convenient network-wide site auditing.

TPC Manager for Palm and *TPC Manager for Windows* provide the following capabilities:

- Event data transfer to your PC or laptop
- Controlling lid position (open/close)
- Status indication of key system components
- Quality control data for in-field problem solving

From your Palm device, a detailed review of all collected data is available after you synchronize to the Palm Desktop. For more information about Palm™ devices go to www.palm.com.



TPC-Manager for Palm Welcome Screen

The initial screen of *TPC Manager for Palm* lists each instrument currently registered, allowing you to manage multiple instruments and view downloaded event data. Selecting "Edit" permits you to edit site *meta* data and add notes. *TPC Manager for Windows* enables real time event recording via the RS-232 port connected to your laptop or PC. Ingest of ASCII event data to customer specific databases is generally possible via customer-provided ASCII data ingest routines.

Add Instrument

Name: NDAP#1

VSN: YES.TP5.333

Notes:

.....

.....

.....

.....

OK Cancel

Palm™ Edit Instrument Screen

Notes can include site details, maintenance log information, operator names or other important site-specific data.

Events

YES.TP5.333

▼ Significant Events

8/25 00:00 2002 - Reset

8/25 04:54 2002 - PStart

8/25 04:54 2002 - LOpen

8/25 17:21 2002 - PStop

8/25 17:21 2002 - LClose

8/26 09:33 2002 - PStart

Alerts All Events

Cancel Graph

Palm™ Events Screen

You use the Event viewer to see detected automation failure alerts or precipitation start/stop events that represent normal operation. You can filter alerts only, and events have GMT/UTC date/times.

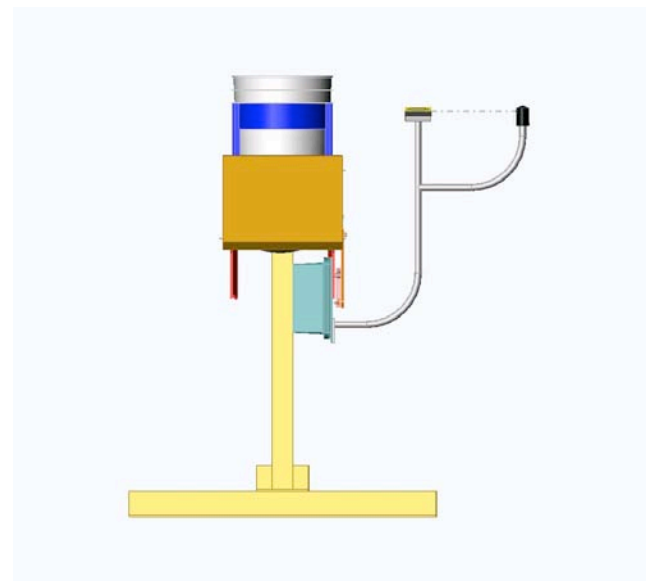
In contrast with the simpler Palm version, *TPC-Manger for Windows* supports Win9x/NT/2000/XP/7 and provides a graphical real time event view. (Note WinCE and Windows Mobile are *not* supported.)

Development History

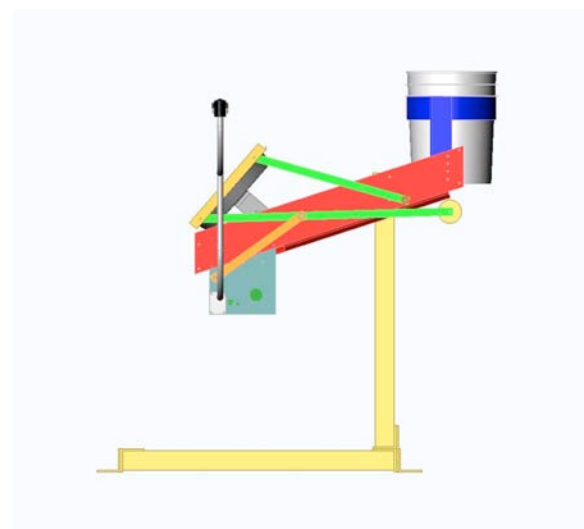
The TPC-3000 was developed in partnership with the US National Oceanic and Atmospheric Administration (NOAA), and incorporates many features suggested by National Atmospheric Deposition Program (NADP) personnel who oversee a large collector network of nearly 300 sites.

Problems on legacy ACM collectors including splash, sensor sensitivity, lid freeze-down, motor gearbox and precipitation sensor failures, poor sensitivity to precipitation under

windy or very light precipitation conditions, and the ink pen recorders were all addressed by the TPC-3000. Multiple government agencies subsequently conducted a long-term collector test of several different collectors. Chiefly due to its advanced sensor and very low splash design, the TPC-3000 system won this competition and is now used worldwide for monitoring atmospheric pollution. Networks demand the unit-to-unit consistency and interchangeability that a TPC-3000 provides.

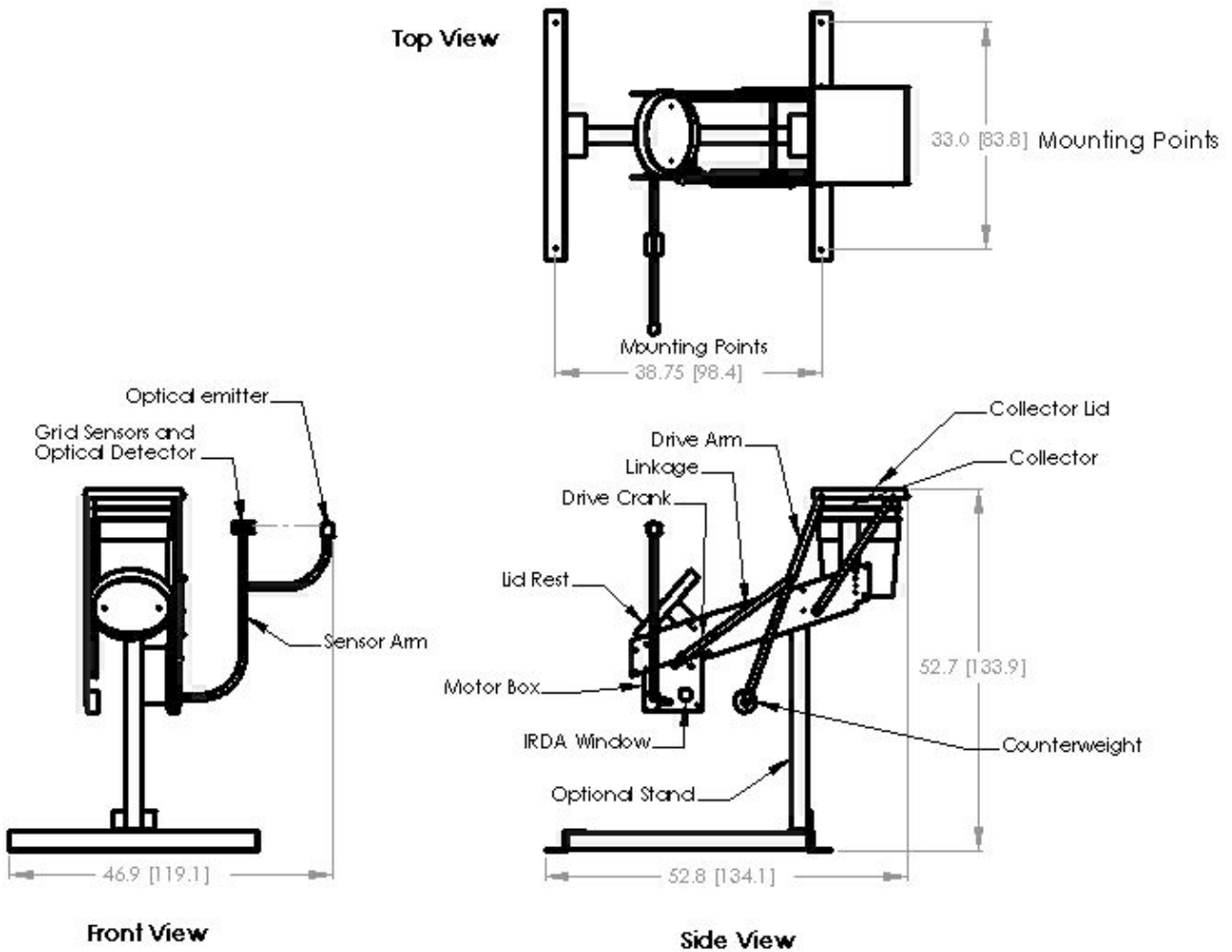


Model TPC-3000 – front view



Model TPC-3000 – side view





Mechanical Interface – dimensions in inches (cm). Shown with optional stand.

Specifications

Power Required	11-15 Vdc @3.1A (max), 2-12W heater configuration, 80mA (typ) w/o heaters or motor operating; 1 mA disconnected. Average depends on duty cycle and heater configuration. Inputs protected from polarity reversal, surges, & over-voltages.
Weight	38 lbs (17 kg) without optional stand battery or collection bucket
Materials	Aluminum, 304 stainless steel, bronze and UV resistant plastics
Operating range	±50°C (YES recommends burying standby battery underground)
Analog input	Tipping bucket rain gauge switch contact; linear 0-5 Vdc rain gauge
Digital output	Wired: RS-232, 9600 baud 8-N-1 9p sub-D; <i>TPC Manager for Windows</i> provided and 0-5Vdc TTL "lid state" output for interfacing with data loggers or PLC Wireless: IrDA, <i>TPC Manager for Palm</i> provided
Options	Heavy duty stand AC power supply Solar Power Package Trapping Filter Column and sample heater option Spare collector bucket



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