

TOTAL PRECIPITATION COLLECTOR

MODEL TPC-3000

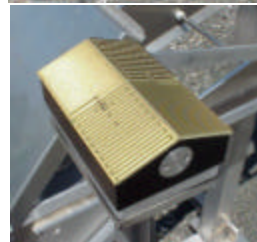
PRELIMINARY BULLETIN TPC-3000



TPC-3000 (shown on optional stand)

OptiGrid Optical + Grid Sensor

The TPC uses a sophisticated dual technology precipitation sensor that sets it apart from other precipitation collectors. A dual beam, near IR optical sensor, uses synchronous detection to detect precipitation. A second, heated dual grid sensor detects very light precipitation events and also logically qualifies the optical sensor output. This way, spiders and insects cannot fool the optical sensor.



OptiGrid Precipitation Sensor

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

$$s(\lambda) = s_0(\lambda) e^{-\tau \delta(\lambda)}$$

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

$$e_m(V) = \frac{r}{0.62197 + r} p$$

$$\frac{dx}{dt} = \frac{1}{\rho} \frac{\partial p}{\partial x} - 2Q \sin \theta - 2Q \sin \phi + F_x$$

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 earliest phases of a precipitation event contain the highest concentrations, and this historical lack of sensitivity has biased sampling. The precipitation sensor represents a major improvement over older technology where the earliest light precipitation events are often missed. An Infrared Data Association® (IrDA) data port permits interaction with the system to view recent operational event history on a Palm handheld. The TPC-3000 is also expandable, accommodating up to two additional slave systems for multiple chemical assays such as Mercury deposition.

Features

- State-of-the-art completely automated precipitation detection and collection
- Integrates with a variety of rain gauges
- Modular design is lightweight and portable, compatible with legacy sampler mounts
- DC battery operation (AC line option)
- Includes Palm™ and TPC-Manager QC software
- Supports operation of large networks

Applications

- Atmospheric deposition at remote sites
- Acid rain and global climate change research
- Input for precipitation forecast models
- Chemical/Bio agent research
- Validation of remote sensing platforms

Distributed Data Collection

Managing a network of precipitation collectors represents a formidable data management and quality control task. Network quality control operations are greatly simplified via TPC data management tools. Collector and rain gauge history can be collected via telephone modems or via IrDA-equipped Palm™ handheld devices that users physically carry to locations with Internet data connectivity back to the central network site.



TPC-3000 with lid closed



TPC-3000 with lid open

Palmä Data Management

In addition to supporting connections to other data loggers and serial terminal devices, you can view data via the supplied Palm handheld device. Inexpensive Palm™ devices are powerful, rugged and easy to transport. With

their ample data storage and built in IrDA support, PalmOS™ devices eliminate the need to bring a laptop and cables to remote collection sites. Palm devices also offer a compelling alternative to other, more expensive handheld devices such as Laptops, which tend to be more fragile.

Once the Palm handheld is synchronized with the Palm Desktop, data can be ingested into other TCP/IP-based databases. System errors such as jam conditions or power outages are logged to permit network level site audits and support online quality control. Periodic maintenance includes cleaning the precipitation sensor and checking the standby battery electrolyte level. The included TPC Manager software for the Palm™ OS has the following capabilities:

- Supports walk-up wireless data transfer to your Palm device via IrDA
- Synchronizes with the Palm Desktop Software
- Provides immediate graphical feedback—you can browse data immediately after collection
- Detectable system failures are immediately apparent to permit on site repairs

A detailed review of all collected data is available after synchronizing to the Palm Desktop. For more information about Palm™ see www.palm.com



TPC-Manager Welcome Screen

The TPC Manager's Instruments screen lists each instrument currently registered with it. You can then manage instruments and view their data. By selecting "Edit", you can also edit instrument/site *meta* data.

Add Instrument

Name: NDAP#1

VSN: YES.TPS.333

Notes:

.....

.....

.....

OK Cancel

Palmä Edit Instrument Screen

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

Events

YES.TPS.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

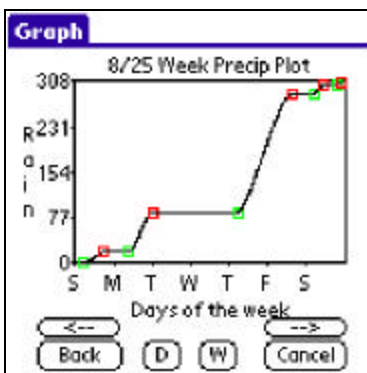
Alerts All Events

Cancel Graph

Palmä 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.

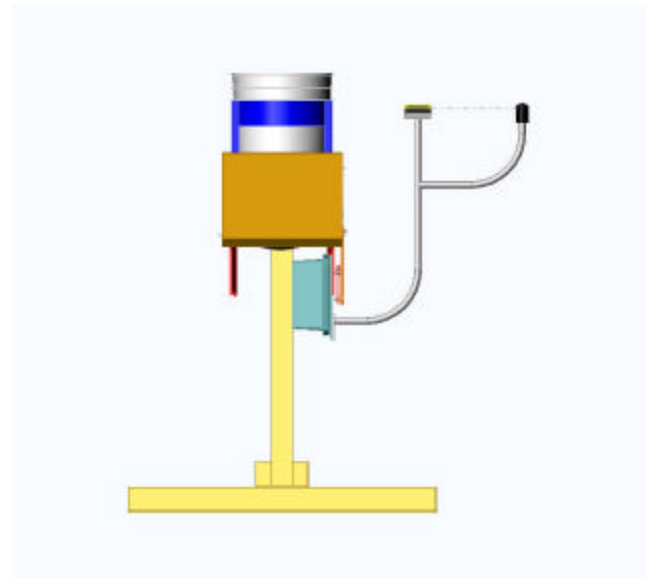
The Graph view gives you a high level visual snapshot of collected data. A graph view is convenient for browsing information, and for correlating vs. rain gauge data. By selecting Day or Week you can zoom the time scale to look at a region of interest.



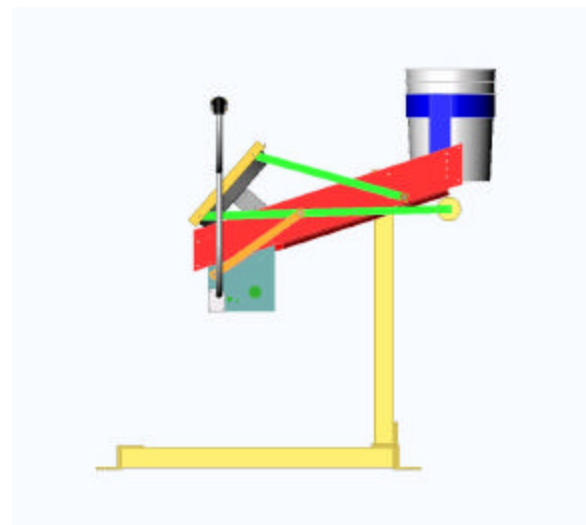
Palmä Graph Viewer Interface

Development History

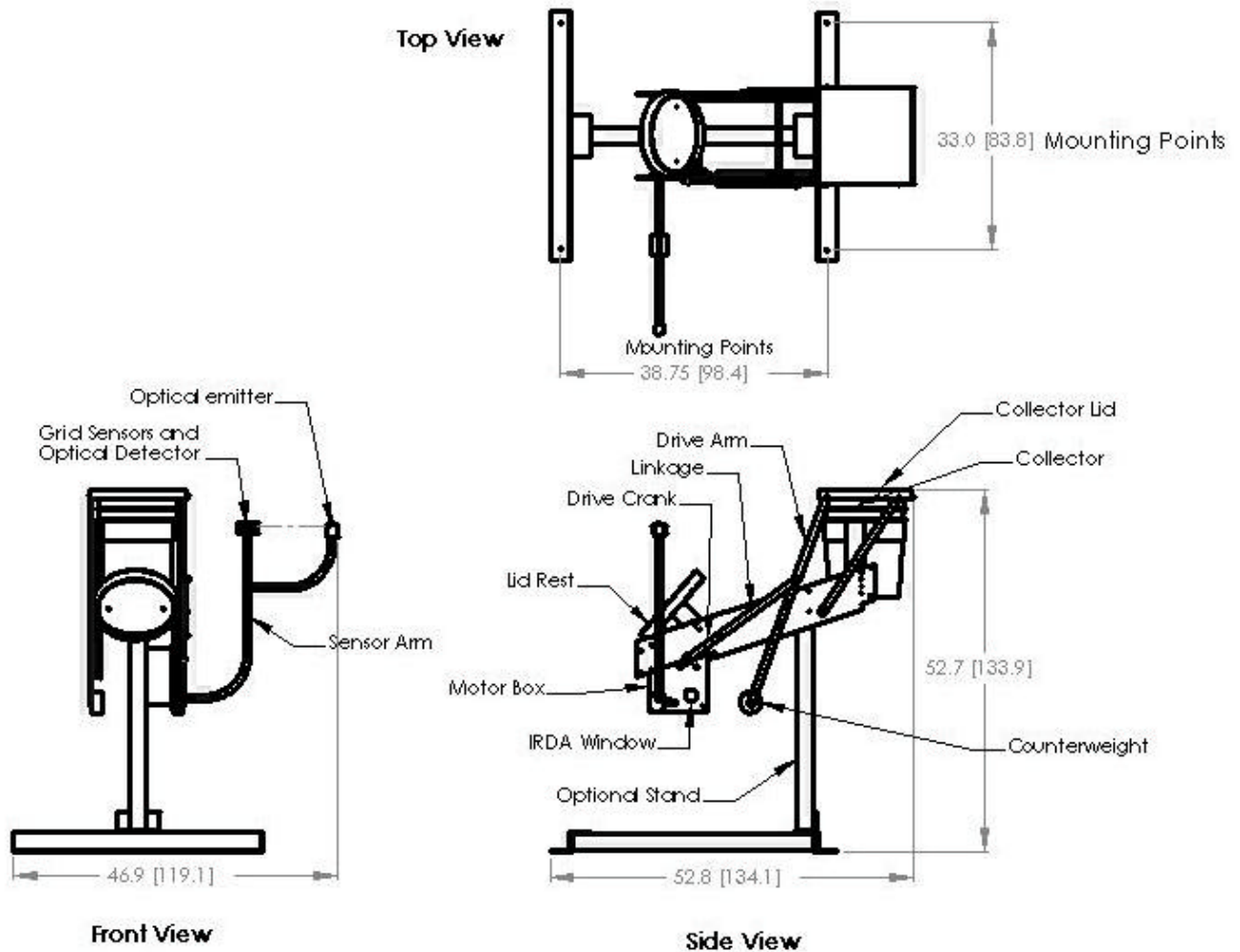
The TPC-3000 was developed in partnership with the National Oceanic and Atmospheric Administration, and incorporates many features suggested by National Atmospheric Deposition Program (NADP) personnel. Problems such as splash and expandability were carefully considered and rectified. Common operational problems solved included lid freeze-down, motor and precipitation sensor failures, and poor sensitivity to precipitation under windy or very light precipitation conditions.



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-voltage conditions. Optional 120 Vac supply available.
Weight	38 lbs (17 kg) without optional stand battery or collection bucket
Materials	Aluminum, 304 stainless steel, bronze and UV resistant plastics
Operating range	+45 to -35°C (YES recommends burying DC 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 9 pin serial D; and 0-5Vdc TTL "lid state" output Wireless: IrDA, (via supplied <i>TPC Manager</i> software)



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