Comparative testing of windmeasuring equipment

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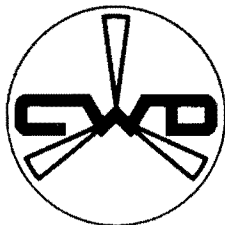
COMPARATIVE TESTING OF

WINDMEASURING EQUIPMENT

part I : inventory and selection

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SUMMARY

This report is the result of the first part of a comparative study of wind measuring equipment. It contains an overview of commercially available systems, based on documentation.

There has been made a division into four classes, according to the measuring possibilities of each instrument. The characteristics of the systems belonging to each class are listed in tables.

After the documentation study quotations were asked for several systems, which has led to the selection of some equipment which will be purchased in order to carry out the second part of the study: the testing of interesting equipment.

Together with some systems that were already available the testing program will include the following wind measuring equipment:

. Windruncounters: ART Windwatch, Datak WP4A, Ekopower 2F,

Natural Power A22;

. Systems processing frequency distributions, etc.: Ekopower 3N,

Datak WP16, NEW Windlogger, Secondwind Al-2000;

. Dataloggers: ART Windwatch/Squirrel, Ekopower 10B,

Natural Power A30, Omnidata DP214,

Secondwind Al-2000S.

CONTENTS

1. INTRODUCTION

CWD promotes the interest for windenergy in developing countries
and aims to help governments, institutions and private parties in
the Third World with their efforts to utilize wind energy.

In relation to these activities CWD is interested in wind measuring
equipment and their suitability for various types of measurements.

In the past an overview of commercially available systems was made
(ref.1). Several systems were purchased and tested (ref.2).

In the last few years new types of dataloggers have appeared, which
store information sequentially in solid state memories, that were
hardly available some years ago.

Besides, some important manufacturers (like Aeolian Kinetics and
Helion) have ceased business and others made their appearance on the
market. In order to keep the (practical) knowledge about wind
measuring systems within CWD up to date a proposal has been made for
comparative testing of wind measuring equipment. In this proposal
two phases were described:

. as a first step the available commercial documentation will be
  organized and completed and a selection of interesting devices to
  be tested will be made;

. the second phase involves windtunnel tests, climate chamber tests
  and outdoor, functional tests.

This report contains the results of the first phase. The knowledge
can be used for consulting, selection of equipment for CWD projects
and/or backstopping of projects using the equipment. Also the
results will be published as part of CWD's transfer of knowledge
efforts.

In this report the following chapter shortly describes the way of classification of the equipment. It is followed by chapter 3 which contains information about the various wind measuring systems. In the last chapter the selection of some interesting types which will be purchased is presented.

2. CLASSIFICATION

Wind measuring equipment can be subdivided into 4 classes, according to Wegley e.a. (ref.3), based on their data storage capability. This storage capability walks along with the application of the instrument.

class nr.	data storage capability	primary application
I	none (instantaneous wind speed meters)	comparison of current wind speeds with WECS output
II	single storage register (wind run counters)	siting studies, determine weekly and monthly average wind speeds
III	processed information (frequency distributions e.a.) is stored in more than one storage register; short-time averages are lost	measurement of frequency distribution; calculation of energy output of wind machines; estimation of Weibull parameters
IV	short-time averages (during a set period) are sequentially stored; distributions can be calculated (by means of a computer, for example)	making wind surveys over large areas; professional siting studies for larger systems

table 1: classification of wind measuring equipment (ref.3)

Classes I to III are specific for wind measurements, but this doesn't count for class IV-instruments: all kind of dataloggers which have the appropriate input-port (e.g. pulse-counting) can be used, the necessary calculations can be made afterwards on a computer.

Therefore class IV is divided into 2 subclasses:

. IV-a contains dataloggers which are specially designed for wind measurements;

. IV-b contains more general dataloggers which can monitor various instruments (e.g. other meteorological sensors and windmills or wind turbines).

3. COMMERCIALLY AVAILABLE WIND MEASURING SYSTEMS

Before overviewing the available equipment it should be noted that all kind of documentation has been studied, but only "outdoor-models" (systems that are supposed to be resistant against rain, sunshine, dust, etc.) were taken into account (this means for example that equipment using strip-chart recorders is not considered in this report). Also the equipment belonging to class I (limited possibilities) and class IV-b is not considered. The latter because these dataloggers are too extensive and in most cases also too expensive. It is also too cumbersome to prepare this equipment for wind measurements, because it cannot be delivered completely and "ready for use".

In the next paragraphs a listing of the commercially available equipment is made, followed by a table in which the main characteristics of each instrument are presented (in order to ease the comparison of the various systems).

3.1 Class II-systems

These systems usually consist of two main parts, the anemometer and the counter unit. Sometimes these two elements are combined to a "totalizing anemometer". The counter unit can have electric counters (LCD, LED) or mechanical counters.

1. ## Atmospheric Research & Technology - Windwatch
   To the counter unit belongs a Maximum anemometer (AC-type). The panel of the Windwatch has no switches or buttons, only an 8 digit LCD display, which shows the wind run and the instantaneous wind speed (sampled every second).

The storage capability is doubled by the use of an overflow indicator which shows that the counter has returned to zero. Also battery indicators are present.

2. Belfort - 5-349C

This totalizing anemometer has a counter which is connected directly to the anenometer by a spindle and gear system. There is also an electrical pulse output, but Belfort doesn't deliver an accumulator which can be connected to it.

3. Casella - W1224

This also is a totalizing anemometer, which works on the same principle as the Belfort-type. There is, however, no electrical output, so reading the mechanical counter (which is only just beneath the anemometer) is necessary.

4. Datak Systems - WP4A

The WP4A is delivered with a Datak Systems anemometer. The LCD display shows the wind run through a transparent display window. A magnetically activated switch allows the display to be reset without opening the enclosure.

5. Ekopower - Wind monitor EKO2F

The wind monitor EKO2F, which uses the Maximum AC-generating anemometer, can measure wind run which in the standard form is shown on an electromechanical counter that can be read without opening the case. This type has many options, like a LCD counter, wind speed indication (analogue or LCD), maximum gust indication, other type anemometer, recorder output, operation time counter.

6. Natural Power - A22

This system also uses a Maximum anemometer (AC-type). It has a 7 digit LED, which can be read by pushing a non-fixable switch.

7. NRG Systems - Wind Totalizer 2800

The 2800 has an internal lithium battery, providing 10 years or more of operation without changing batteries. The present wind speed is displayed with a blinking colon (:); the blinkrate equals the wind speed.

8. Parkway Energy Products - Wind run accumulator

This accumulator uses a contact anemometer. The mechanical counter which is resettable shows the total wind run. The instantaneous fastest mile of wind to pass can be read when using a special module (optional).

9. Summit Controls - Wind run Totalizer WGC-100

This system uses an AC-generating anemometer. The wind run is accumulated in an 8 digit counter and continuously displayed on a LCD readout. There are no pushbuttons, switches or doors. The total count can be reset by momentarily removing the battery pack.

10. Weathermeasure/Weathertronics - Totalizing anemometer

The totalizing anemometer is of the same type as the Belfort product. A mechanical counter is driven directly by the rotating anemometer. It has an electrical contact output (no special counter for remote use available).

CLASS II	ART	Bel-fort	Cas.	Datak Syst.	Eko-power	Nat. Power	NRG	Park-way	Sum-mit	Weath.
dimensions (cm.cm.cm)	25.18 .15	14.11 .6	?	15.8 .8	17.13 .9	25.15 .10	23.14 .8	?	11.8 .5	40.31 .?
weight (kg)	2,7	1,3	3,6	0,6	1,0	1,3	0,9	?	1,3	2,3
batteries	+	-	-	+	+	+	Li-cel	+	+	-
batterylife (months)	6			24	6	12	120	1	12	
temp.range (deg.C)	-30 55	?	?	-35 70	-25 65	-40 60	-20 60	?	?	?
anemometer included	max40	+	+	+	max40	max40	max40	?	+	+
max.speed (m/s)	45	?	?	45	45	45	45	?	45	45
display	LCD	m.c.	m.c.	LCD	m.c.	LED	LED	m.c.	LCD	m.c.
digits	8	5	6	6	7	7	7	6	8	6
memory capacity *	744	37	23	372	2315	620	372	3724	175	372
instant. speed	+	-	-	-	o	-	-	-	-	-
peak wind speed	-	-	-	-	o	-	-	o	-	-
price	$500	?	175	$275	f895	$205	$310	$100	$195	f2340
date	1986	1986	1980	1986	1986	1985	1986	1983	1984	1985

```
    * = days at 5 m/s
  m.c. = mechanical counter
     o = optional
 max40 = Maximum type #40
```

3.2 Class III-systems

When using one of these instruments it is not necessary to make use
of more dataprocessing apparatus: all the necessary calculations to
obtain output like frequency distributions, etc. take place inside
the system itself.

1. ### Berewoud Energie - Wind classifier "Windwijs"
    The Windwijs is the Dutch trade-name for the Wuwikl from
    Wuseltronick. It is available in three versions. The standard
    version offers a frequency distribution in 20 classes, a
    calm-duration distribution in 8 classes and measurement of the
    maximum wind speed. The LCD display allows operation checks,
    delivers data output and offers the actual wind speed every
    minute. Another way of data reading is by use of a printer
    (optional).

2. ### Datak Systems - WP16
    This wind frequency analyzer stores a frequency distribution in
    16 bits. The bin width is factory programmable. The readout of
    the data goes by 6 digit LCD's (16x) which can be read
    continuously.

3. ### Ekopower - Windregime Analyzer EKO3N
    The EKO3N also stores a frequency distribution in 7
    non-volatile wind class counters (options: 10 or 13 classes).
    Furthermore the wind run and the operation time are counted.
    More options are the instantaneous wind speed (analogue or
    LCD), maximum gust indication, other type anemometer (instead
    of Maximum), recorder output.

4. <u>Environdata - Anemometer Analyzing Recorder (Anarec)</u>

The Anarec can in fact also be compared with class IV instruments, because it is possible to retrieve hourly wind speed averages covering a 5 week period. The data can be read manually or transferred to an Apple computer. The main function, however, is storing wind speeds in an 18 bin frequency distribution which can be read from a 4 digit display. It is also possible to read the present wind speed. When the anemometer is not connected to the recorder for more than one hour, the Anarec will enter a "sleep" mode. Then a control box is needed to reactivate the system.

5. <u>G.T.S. - Anemometer Euclide Pw</u>

The Euclide prints out hourly wind speed averages and there is an analogue indication of the instantaneous wind speed. It is necessary to operate the system by means of a solar panel.

6. <u>M.A.N. - Wind Classifier</u>

This wind classifier stores the wind speed in 5 classes (displayed by mechanical counters). There is also a total counter. The present wind speed is shown on an analogue display. It is not possible for the system to operate on batteries: a choice can be made between a solar panel or 220V-AC.

7. <u>Northumbrian Energy Workshop - Windlogger</u>

The Windlogger has a 30-bin frequency distribution. It must be read by a 16 digit LCD display, which also gives the present wind speed and the total elapsed time (when reading the data). Reading the distribution can be done at any time by using a single switch.

8. <u>NRG Systems - Wind Challenger 7010</u>

The Wind Challenger continuously computes and displays several functions: present wind speed, average wind speed, peak wind gust, hour of peak wind gust, elapsed time, power density, hours above cut-in speed and duration of wind energy lull below setpoint (cut-in speed and setpoint are user selectable). These functions all have instantane values (because the Wind Challenger has a volatile memory) which can be displayed by using a select button.

9. <u>Parkway Energy Products - Wind Site Analyzer</u>

The Wind Site Analyzer records wind run counts over distinct periods of time. Each of 4 mechanical counters can be pre-programmed to record wind counts during a special period. These periods are automatically repeated on a specific day, for an entire week, a month or a year.

10. <u>Secondwind - Al 2000</u>

The Al 2000 system stores a wind speed frequency distribution, a 2 hour diurnal distribution and a wind direction distribution. It also memorises the maximum wind speed, the duration of the longest energy lull and their time of occurrence, on a monthly basis. Furthermore it is possible to read the present wind speed. The stored data can be accessed directly from the front panel of the instrument by using the selection keyboard.

CLASS III	Bere-woud	Datak Syst.	Eko-power	Env. data	GTS	MAN	NEW	NRG	Park-way	Sec. wind
dimensions (cm.cm.cm)	?	22.12 .8	17.13 .9	14.12 .11	?	16.8 .6	32.22 .5	20.17 .14	?	25.20 .10
weight (kg)	?	0,9	1,5	0,7	?	?	0,8	?	?	4,5
batteries	+	+	+	+	+	−	+	+	+	+
batterylife (months)	6	12	6	1	?		12	12	?	12
temp.range (deg.C)	−20 70	−35 70	−25 65	?	?	−20 70	−20 60	−40 70	?	−40 70
anemometer included	+	−	max40	+	+	+	+	max40	max40	max40
max.speed (m/s)	?	45	45	?	?	60	60	45	45	45
display	LCD	9xLCD	9xm.c.	?	−	6xm.c.	LCD	LCD	4xm.c.	LED+ LCD
digits	?	6	5	4		4	16	4	5	?
memory capacity *	20	?	70	?	−	?	416	−	?	395
instant. speed	+	−	o	−	−	+	+	+	?	+
peak wind speed	+	−	o	−	−	−	−	+	−	+
frequency distr.	+	+	+	+	−	+	+	−	−	+
diurnal distr.	+	−	−	−	+	−	−	−	+	+
direction distr.	−	−	−	−	−	−	−	−	−	+
calm distr.	+	−	−	−	−	−	−	+	−	+
standard deviation	−	−	−	−	−	−	−	−	−	+
data retrieval	D,Pr	D	D	D	Pr	D	D	D	D	D
price	f3300	$725	f2295	$1260	?	D1900	270	$540	$650	$1675
date	1986	1986	1986	1986	1986	1982	1986	1986	1983	1986

```
    * = days at 5 m/s
 m.c. = mechanical counter
    o = optional
max40 = Maximum type #40
    D = display
   Pr = printer
```

3.3 Class IV - systems

These dataloggers can be subdivided into:

IV-a: sequential dataloggers for wind speed and/or direction;

IV-b: sequential dataloggers for wind turbine performance and more general purpose multifunctional dataloggers.

Characteristic of both classes is that only averages are stored: in order to obtain frequency or diurnal distributions, etc. more data processing aparatus is necessary (computer, processing software, interface between datalogger and computer).

3.3.1 IV-a: dataloggers for windmeasurements only

1. **Atmospheric Research & Technology - Windwatch II/squirrel**

   The Windwatch II is the same as the Windwatch, except that it offers the possibility to install a squirrel memory module, which can store 30 or 60 minute wind speed averages (for 42 or 85 days). To read the data the squirrel must be interfaced to a computer by means of an RS-232 converter for squirrel-data, which can be purchased from ART. There is also software available (for IBM computers) to calculate daily, diurnal, wind speed and power distributions.

2. **Ekopower - Wind datalogger EKO10**

   There are several Ekopower wind dataloggers available.

   In table 4 the main features of the EKO10B are listed.

   The recording interval of the EKO10 dataloggers offers various possibilities: one can choose between freely programmable intervals (1 sec. to 100 min.), 10/60 min. intervals (front selectable) and 10/20/../100 min. intervals (internally

adjustable). Recording the maximum gust is optional.

The datalogger unit can be taken separately to a computer or a portable computer can be taken to the field. Data are read into the computer by use of a data transfer program which is delivered with the datalogger. Some standard software for data analysis can be purchased from Ekopower (appropriate for IBM, Epson and compatibles).

3. Environdata - Easidata

The Easidata system can measure wind speed and wind direction averages and wind speed peak values over any interval, which must be specified at order. The datalogger is delivered with the user specified program contained in an EPROM. Data can be read on site by means of a portable computer or printer or by direct cable link to a central (office) computer.

4. Natural Power - Compilator A30-501

The sample period of the Compilator is selectable from 1 sec. to 8 hrs. Data can be read by means of cassette tape (which can be directly unloaded into Apple and IBM computers without need of a tape recorder), by means of the standard printer output, or manually by display. There is software available for data analysis. Besides speed averages also peak wind speed, time of occurrence and present wind speed and direction can be displayed.

5. Omnidata - Wind recorder DP214

The Datapod 214 measures wind speed and direction averages over one of 8 user setable recording intervals. Data are stored in an EPROM. This can be read manually by display, or by the use of a

special EPROM reader which can be connected to a computer by means of an RS-232-c serial interface.

It is possible to transmit data directly on command of the reader, so no data retrieving software is needed. There is no data processing software available.

In order to erase the EPROM a UV erasing lamp can be purchased from Omnidata.

6. Secondwind - A1-2000S

The A1-2000S is an extended version of the A1-2000. In addition to the data sets maintained by the A1-2000, the S-version records hourly average wind speeds in series. It is possible to read the data by display, but there also is a special EPROM reader available (and an EPROM eraser), as well as transferring and processing software for IBM computers.

7. Summit Controls - Datalogger system WGC-110

The WGC-110 collects data in an EPROM memory. The recording period is switch selectable (15,30 or 60 min.). There are pushbuttons and indicators for control of batteries and sensors. Data retrieving goes by means of an EPROM reader which is not directly available at Summit Controls. Also an erasing lamp and software cannot be ordered directly.

CLASS IVa	ART	Eko-power	Env. data	Nat. Power	Omni-data	Sec. wind	Sum-mit
dimensions (cm.cm.cm)	25.18 .15	27.18 .17	28.21 .18	28.23 .19	16.8 .6	25.20 .20	25.17 .15
weight (kg)	2,7	3,0	2,0	2,3	0,5	4,5	5,4
batteries	+	+	+	+	+	+	+
batterylife (months)	16	6	1	?	6	12	1
temp.range (deg.C)	-30 55	-25 65	-10 50	-40 70	-35 60	-40 70	-30 70
anemometer included	max40	max40	+	+	+	max40	+
max.speed (m/s)	45	45	?	?	?	45	?
display	LCD	LCD	-	LED	LCD	LED	-
digits	8	?		8+2	4,5	?	
memory capacity	2kb	16kb	4kb RAM	?	2kb EPROM	4kb EPROM	4kb EPROM
peak wind speed	-	o	+	+	+	+	-
recording period(min)	30/60	var	var	var	var	60	15/30/ 60
wind direction	-	o	+	+	+	+	+
calm duration	-	-	+	-	-	+	-
standard deviation	-	-	-	-	-	+	-
data retrieval	M	M,P	P	D,C	D,E	D,E	E
processing software	+	+	+	+	-	+	-
price * **	$790 $2485	f6250 f7045	$3340 $5250	$1500 $1800	$1110 $2025	$1970 $3050	$1195 ?
date	1986	1986	1986	1986	1986	1986	1984

```
    * = standard                              D = display
   ** = complete (+ reader and software)      C = casette recorder
    o = optional                              M = module reader
  var = variable (user settable)              E = EPROM reader
max40 = Maximum type #40                       P = portable computer
```

3.3.2 IV-b: more extensive dataloggers

It should be noted that this report describes specific wind measuring equipment. Therefore no attempt was made to make the class IV-b list complete.

1. Bottemanne - DP100 Dataprocessor

    There are several extensions (more inputs, analogue or digital) available for the DP100, which has 30 analogue and digital input channels. The standard way of data control and retrieval is by means of an Epson portable computer (storage on microcassette), but it is also possible to order an RS-232 interface and control and retrieve software for other computers.

2. Campbell Scientific - 21X Micrologger

    The standard 21X includes 32 inputs (analogue, digital). There is a connector on the front panel for serial data communication to cassette tape, memory module, modem, or printer. It can also be used for system programming (data processing, etc.) via remote terminal or computer.
    Data can also be read from display.

3. Data Electronics - Datataker 100F

    The datataker must be programmed with a computer. Then it can read up to 54 channels. The DT100F communicates with any computer via an RS-232/RS-422/RS-423 interface. It can be connected directly to a computer, there are no extra modules needed and no special software is necessary.

4. <u>Dulas Engineering - Datalogger</u>

There are 24 input channels available in this datalogger. In order to operate it with wind sensors special input modules are needed which can be delivered by Dulas. Communication to a computer goes by the BASIC computer language.

5. <u>Ekopower - EKO10C</u>

The EKO10C is another datalogger from the EKO10 family. It is designed for windpower evaluation. Recording channels are wind speed, wind direction, wind power output and density of air. There are no options for instantaneous speed indication or peak wind speed. Furthermore signal conditioning, data processing, etc. are the same as for the EKO10B.

6. <u>Grant - Squirrel meter/logger</u>

There are a lot of Squirrel models available, including some which can be used for wind measurements. The Squirrel can be used as a meter or recorder, or both at the same time. When used as a logger, recordings are taken from each channel and stored at user selected intervals. Recording is unaffected by use as a meter. Data can be read by display, by RS-232-c output, or as 8-bit parallel, under control of pushbuttons. There is standard software available for a number of computers (Epson, Apple, Hewlett Packard, e.g.) to carry out data transfer and analysis.

7. <u>New Energy Systems - Datalogger Modas 12</u>

The Modas 12 has 23 input channels. It uses plug-in memories for data storage. Data can be read by the use of a special transmitter unit with RS-232/V24-interfaces (transfer software included). Direct transferring and processing software can only be delivered for Commodore computers.

CLASS IVb	Botte-manne	Camp-bell	Data Electr.	Dulas	Grant	NES	Eko-power
dimensions (cm.cm.cm)	?	21.15 .8	27.24 .8	40.30 .20	20.18 .13	?	27.18 .17
weight (kg)	?	2,8	3,0	?	2,5	?	3,0
batteries	+	+	-	+	+	+	+
batterylife (months)	?	?		1	6	?	6
temp.range (deg.C)	-30 60	-25 50	-20 55	?	-30 65	-20 55	-25 65
display	LCD	LCD	-	-	LCD	-	LCD
digits	?	8			4		?
memory capacity *	32	40	24	?	2	8	16
input ports analogue	30	18	46	16	4	16	?
digital		6	8	8	1	0	?
pulse count	0	4	8	2	1	7	?
recording period	var	var	var	var	var	var	var
data retrieval	P	D,M,C,P	?	C,P	M,P	M	M,P
interface/ software	+	+	-	-	+	-	+
price	f16000	$3000	$2000	1600	f2700	D14000	f10000
date	1985	1985	1986	1985	1984	1985	1986

```
    * = kb RAM
  var = variable (user settable)
    D = display
    M = modulereader (RAM)
    C = cassette recorder
    P = portable computer
```

4. SELECTION OF INTERESTING EQUIPMENT FOR TESTING

In a first stage a rough selection (based on documentation) has been made to decide for which instruments quotations should be asked for. Based on these quotations it was decided which instruments will be purchased for testing.

As a result of the first selection 4 class II systems, 6 class III systems and 1 class IVa system were taken out of consideration:

. class II: 3 of the 4 drop-outs are totalizing anemometers (Belfort, Casella, Weathertronics) which are very unpractical;

furthermore the information about the Parkway accumulator is quite old and a demand for recent documentation was not replied to;

the Natural Power A22 and the EKO2F were already available at WEG.

. class III: the Berewoud, the Environdata and the Secondwind products are relatively too expensive for class III instruments;

the M.A.N. Windclassifier cannot operate on batteries;

for the Parkway Windsite Analyzer the same story holds as for the other Parkway product;

the GTS Euclide is not very reliable as some testing on this instrument in Somalia has shown;

the EKO3N was already available.

. class IVa: the only datalogging instrument that is not taken into account is another Environdata product (Easidata), which is too expensive;

again the Ekopower type was already available at WEG.

After the first selection, 7 manufacturers were asked for quotations on one or two of their products: Atmospheric Research & Technology, Datak Systems, Northumbrian Energy Workshop, NRG Systems, Omnidata International, Secondwind and Summit Controls Corporation.
One month after sending the quotation inquiries the NRG and the Summit Controls companies had not returned a quotation yet, so these firms were not selected to order equipment from.

. For class II this means that 4 wind run counters remain to be chosen from:
  the ART Windwatch is too expensive for just wind measurements; the Datak WP4A looks promising, so it will be purchased; the Ekopower 2F and the Natural Power A22 are already available.

. In class III only 3 instruments are remaining: the Datak WP16 and the NEW Windlogger will be purchased; the Ekopower 3 is already available.

. In class IV-a the only (new) dropout after the quotation inquiries is the Summit Controls WGC-110 (no reply). The other 5 systems seem worthwile to be tested and 4 of them will be purchased (Ekopower 10B is already available).

It should be noted that the ART Windwatch can also be used as a wind run counter (the wind run version has the same configuration except for the possibility to insert a squirrel module) and that the Secondwind Al-2000S can also be used as the class III version Al-2000 (the only extra feature of the S-version is the recording of hourly averages).

Summarizing, the following instruments will be tested:

Class II   ART Windwatch

                Datak WP4A

                Ekopower 2F

                Natural Power A22

Class III   Ekopower 3N

                Datak WP16

                NEW Windlogger

                Secondwind A1-2000

Class IVa   ART Windwatch/squirrel

                Ekopower 10B

                Natural Power A30

                Omnidata DP214

                Secondwind A1-2000S

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    Eindhoven University of Technology (nr.R-725-D);

[3] A siting handbook for small wind energy conversion systems,
    H.Wegley, J.Ramsdell, e.a., 1980,
    Windbooks.

ANNEX A: LIST OF MANUFACTURERS

Atmospheric Research & Technology, Inc.

6040 Verner Avenue

Sacramento, CA 95841, U.S.A.

Dutch representative:

Belfort Instrument Company   Hollinda b.v.

727 S.Wolfe Street   Eisenhowerlaan 112

Baltimore, MD 21231, U.S.A.   2517 KM 's Gravenhage

The Netherlands

Berewoud Energie

P.O. Box 223

3900 AE Veenendaal, The Netherlands

Bottemanne Weather Instruments

P.O. Box 70411

1007 KK Amsterdam, The Netherlands

Campbell Scientific, Inc.

P.O. Box 551

Logan, Utah 84321, U.S.A.

Casella London Ltd.

Regent House, Brittannia Walk

London, N1 7ND, England

Datak Systems, Inc.

P.O. Box 129

Harmony, RI 02829, U.S.A.

Data Electronics

42 Rutland Road, Box Hill

Victoria, 3128, Australia

Dutch representative:

Depex b.v.

Dorpsstraat 85, P.O. Box 27

3730 AA De Bilt

The Netherlands

Dulas Engineering Ltd.

Llwyngwern Quarry, Machynlleth

SY20 9AZ, Wales

Ekopower

Monarchstraat 46

5641 GJ Eindhoven, The Netherlands

Environdata Australia Pty Ltd.

P.O. Box 395

Warwick, Queensland 4370, Australia

Grant Instruments Ltd.

Barrington

Cambridge CB2 5QZ, England

Dutch representative:

Ahrin Instrumenten b.v.

P.O. Box 80

2280 AB Rijswijk

The Netherlands

G.T.S.

C.P. 1691

20101 Milano, Italy

Dutch representative:

M.A.N.   Rollo b.v.

Neue Technologie, Abt.EA   P.O. Box 275

Dachauerstrasse 667   2501 CG 's Gravenhage

D-8000 Muenchen 50, West-Germany   The Netherlands

Natural Power Inc.

Francestown Turnpike

New Boston, NH 03070, U.S.A.

N.E.S.

Dr.Falk Auer, Berliner Strasse 6

D-6456 Langenselbold, West-Germany

Northumbrian Energy Workshop Ltd.

Tanners Yard, Gilesgate, Hexham

Northumberland NE46 3NJ, England

NRG Systems

Church Hill Road

Charlotte, VT 05445, U.S.A.

Omnidata International Inc.

P.O. Box 3489

Logan, Utah 84321, U.S.A.

Parkway Energy Products

22 Parkway Road, Suite 2

Brookline, MA 02146, U.S.A.

Secondwind, Inc.

7 Davis Square

Somerville, MA 02144, U.S.A.

Summit Controls Corporation

1215 High Street, Suite 103

Auburn, CA 95603, U.S.A.

Weathermeasure/Weathertronics

P.O. Box 41039

Sacramento, CA 95841, U.S.A.

<u>Dutch representative</u>:

Intechmij b.v.

P.O. Box 43068

2504 AB 's Gravenhage

The Netherlands

Wuseltronick

Gneisenaustrasse 2

1000 Berlin 61, West-Germany

ANNEX B: DOCUMENTATION

CLASS II:

Manufacturer	number of pages
Atmospheric Research & Technology	3
Belfort Instrument Company	1
Casella London	1
Datak Systems	1
Ekopower	2
Natural Power	1
NRG Systems	1
Parkway Energy Products	1
Summit Controls Corporation	1
Weathermeasure	1
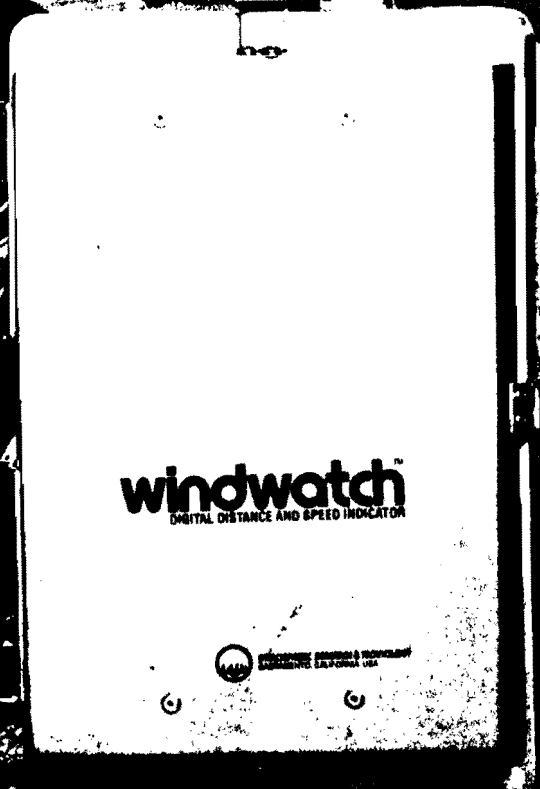
MEASURE MEAN AND INSTANTANEOUS WIND SPEED

windwatch™
DIGITAL DISTANCE AND SPEED INDICATOR

WINDWATCH SPECIFICATIONS

Display	8 digit LCD:	94 0 mm (3 70 in) wide
		12 7 mm (0 50 in) high
Range	Wind distance:	0 to 199,999 9 km (or mi)
	Wind speed:	0 to 99 m/s (or mph)
Power Requirements	Source:	4 alkaline C-cells
	Consumption:	0 200 mA maximum (at 25C)
		1,200 mW maximum (at 25C)
Battery Duration	4 C-cells:	6 months minimum
	Warning:	Dual low-battery indicators
Operating	Electronics:	−40C (−40F) to +80C (176F)
Temperature	LCD:	−30C (−22F) to +80C (176F)
Range	Alk batteries:	−40C (−40F) to +55C (130F)
Enclosure	Fiberglass:	Non-corrosive, weathertight, dusttight, oiltight, Nema Type 4, 4X, and 13 with stainless steel quick-release latches, hinges, lockable hasp
Size	Height:	254 mm (10.0 in)
	Width:	178 mm (7.0 in)
	Depth:	152 mm (6.0 in)
Weight	Net:	2 7 kg (6.0 lb)
	Shipping:	5 5 kg (12.0 lb)
Anemometer	3 cup	Black Lexan, rotating magnet with long-life coil sensor
Accuracy	Anemometer	4% at 7 m/s (16 mph)
		2% above 14 m/s (32 mph)
	Electronics:	Distance 1%, speed 2%
Accessories	Included:	Mounting hardware
		15 m (50 ft) cable
		Operator's manual
Options	Units:	Metric or English
Warranty	15 days	Customer satisfaction
	Twelve months	Parts and Labor
Price	Complete	*S. price plus tax
		FOB Sacramento, CA U.S.A.
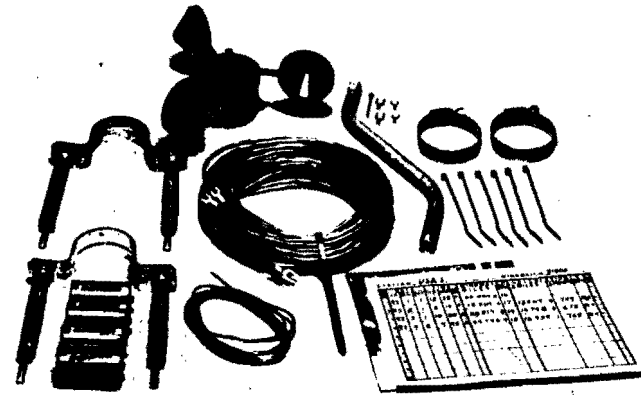
Customer satisfaction guarantee

ART is dedicated to high quality products and customer satisfaction. We are confident that our wind indicator is the finest available, and once you purchase a Windwatch indicator, we will refund your money if you are not satisfied with our product. Offer good for 15 days after purchase or delivery.

Parts List
- Windwatch™ indicator
- 4 Eveready ENERGIZER® alkaline C-cells installed
- Maximum Type 40 anemometer
- Anemometer mounting tube and cotter key
- 50 ft twisted-pair 20 gage anemometer cable with terminals
- 6 black nylon cable ties
- 4 spare cable connectors
- 4 ft grounding wire
- 2 No. 20 hose clamps
- 4 4½" x ¼ carriage bolts
- 4 sleeves for bolts
- 4 nuts (stainless steel)
- 2 1½"H. W. mast straps
- Operator's manual
- Log sheets

Atmospheric Research
& Technology, Inc.
6040 Verner Ave.
Sacramento, CA 95841
(916) 332-2255   (916) 332-2373
Telex 171627   Twx 9103790029

W36 Printed in USA

WINDWATCH™

SETS NEW STANDARDS FOR WIND DISTANCE MEASUREMENT

Mean wind speed is a standard climatological wind measurement and the single most important measurement for estimating energy output of wind machines.

The WINDWATCH™ digital distance and speed indicator shows you the accumulated wind distance and the instantaneous wind speed. To get mean wind speed, divide elapsed distance by elapsed hours. The Windwatch indicator can be used either as an independent recorder or in area wide studies in association with a separate nearby time-resolved recorder.

To design and build the Windwatch indicator, we made use of some of the most advanced techniques ever brought to bear in a distance and speed indicator. The result is a unique, high-tech wind indicator that provides reliable performance and simple operation. Every feature of the Windwatch is the result of careful design. The Windwatch indicator is unsurpassed in overall performance characteristics.

Atmospheric Research & Technology, Inc (ART) is a leader in wind-energy measurement. Now you can have a wind distance and speed indicator that can lay genuine claim to an extensive field experience heritage.

Dual battery holders each hold four C-cells. Made of non-corrosive stainless steel, they maintain high pressure on the battery terminals and meet MIL Spec 17919. Only one battery holder (four C-cells) is necessary to operate the Windwatch. The second holder allows you to load new batteries before removing old batteries. This keeps the wind distance accumulator operating continuously.

Polarized terminals (red caps) allow battery contact only when the positive terminal is up. Each holder has a sign showing the positive battery direction.

Velcro straps retain the batteries during shock or vibration.

Extremely low power consumption extends battery life, reduces operating cost and increases reliability

Each Windwatch indicator is shipped with four alkaline C-cells installed When you open your Windwatch, the display will be operating. Four alkaline C-cells provide approximately five times the battery capacity needed for 12 months of normal operation. Alkaline C-cells are economical, readily available and provide extended temperature operation.

Tough fiberglass enclosure has NEMA (National Electrical Manufacturers' Association) Type ratings 4, 4X and 13 for corrosion-resistant, weather-tight, dust-tight and oil-tight performance.

Hinges and quick-release latches are corrosion-resistant stainless steel. A lockable hasp allows you to add your lock.

Battery wires are 16x30 18g tinned copper with vinyl insulation, rated −40C to +105C for high flexibility, toughness and outdoor durability.

100% high-quality components are rated to operate from −40C (−40F) to +80C (176F). The LCD dims below −30C (−22F) but data is not lost. The circuit board is rubber mounted for shock resistance. All components and cables are soldered for high reliability. All cable exits are strapped. Corrosion inhibitor tape is used behind the circuit board.

Built in lightning resistant circuitry includes a gas surge arrestor, a power absorbing diode and a self-healing capacitor. The Windwatch is designed to withstand large voltage surges and continue operating without data loss.

Four mounting holes, access only when the door is open, ac ¼ inch (6 mm) bolts or screws tening enclosure to external br or panel. Vandal-resistant har included for attaching the Win to a 2" diameter mast.

Anemometer and grounding t are corrosion-resistant stainle bolts for durability and easy c tachment. The left bolt is for a ing wire. The other two bolts a the anemometer cable.

VOLTS

`14137.724`

MILES   MPH
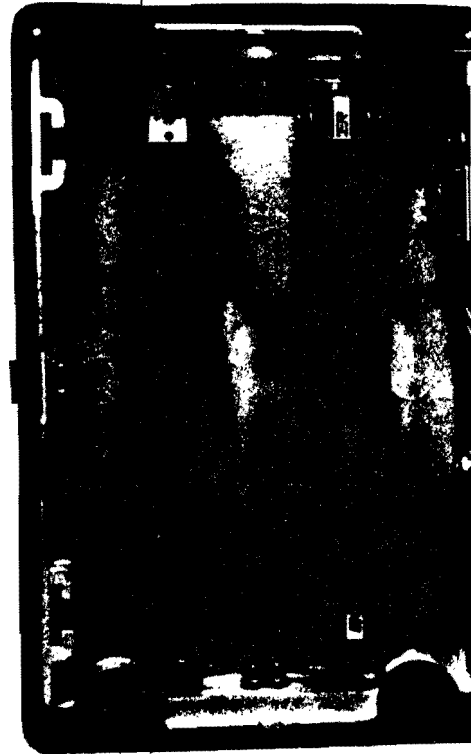
Large, ½ inch high liquid crystal display (LCD) is easy to read even in bright sunlight and operates continuously.

The attractive panel has no switches, buttons or controls. Their absence increases reliability and simplifies operation.

Wind distance (six digits) is shown in miles (or kilometers), with resolution to 0.1 and zero return at 100,000. Like an automobile distance indicator, it operates without being reset. This increases data usefulness and reliability.

Wind speed (two digits) is shown from 0 to 99 mph (or m/s) and is updated approximately each second. Quartz crystal timing assures that speed calculations are accurate and stable and are not affected by changes in voltage or temperature.

The metric model shows wind distance in kilometers and wind speed in meters per second.

Distance overflow indicator (shown by the left-most decimal point) changes from off to on and vice-versa each time the distance accumulator returns to 00000.0. This provides a non-redundant distance range of 200,000 (miles or km), which will take 10,000 hours, or more than a year, to accumulate in 20 mph mean wind. (The kilometer distance used in the metric model will take 6178 hours in a 9 m/s mean wind to return to zero.)

Built-in battery indicators show "good", "warning" and "low" voltage conditions by one (:), two (::) and three (:::) colons, respectively. You do not need a voltmeter. Sufficient warning time is used to assure that you will not lose data. These indicators also test new batteries before you remove the old ones.

The anemometer used with the Windwatch is the Maximum Type 40 which has proven its durability in extreme weather conditions. Made of lexan, the Maximum Type 40 uses a rotating magnet and long-life electric coil sensor to produce a sine-wave voltage at the terminals.

The circuit board may be reset to accommodate switch-closure anemometers and different distance and speed scales.

The anemometer mounting tube provided is offset to allow the use of a lightning rod. Cable ties, stainless steel hose clamps and 50 ft (15m) twisted-pair cable are included. The lightning rod, a pointed ⅛ to ¼ inch diameter rod, is user provided.

To collect data enter date, tim Windwatch readings on the lo We provide log sheets and ins tions which show you how to e calculate elapsed hours and d mine mean wind speed (in mp or kph).

Useful time periods for data c are monthly, weekly or daily. B the Windwatch is not reset, se periods may be used simultan

The collection of monthly reco best done by reading the Wind during a specified 12-hour inte the beginning of a month. An e is the first day of each month b 6 AM and 6 PM.

Good mountings for the anei ter are 40 ft "TV" masts, poles ers. Good exposure usually re being 30 to 40 ft above the lev vegetation.
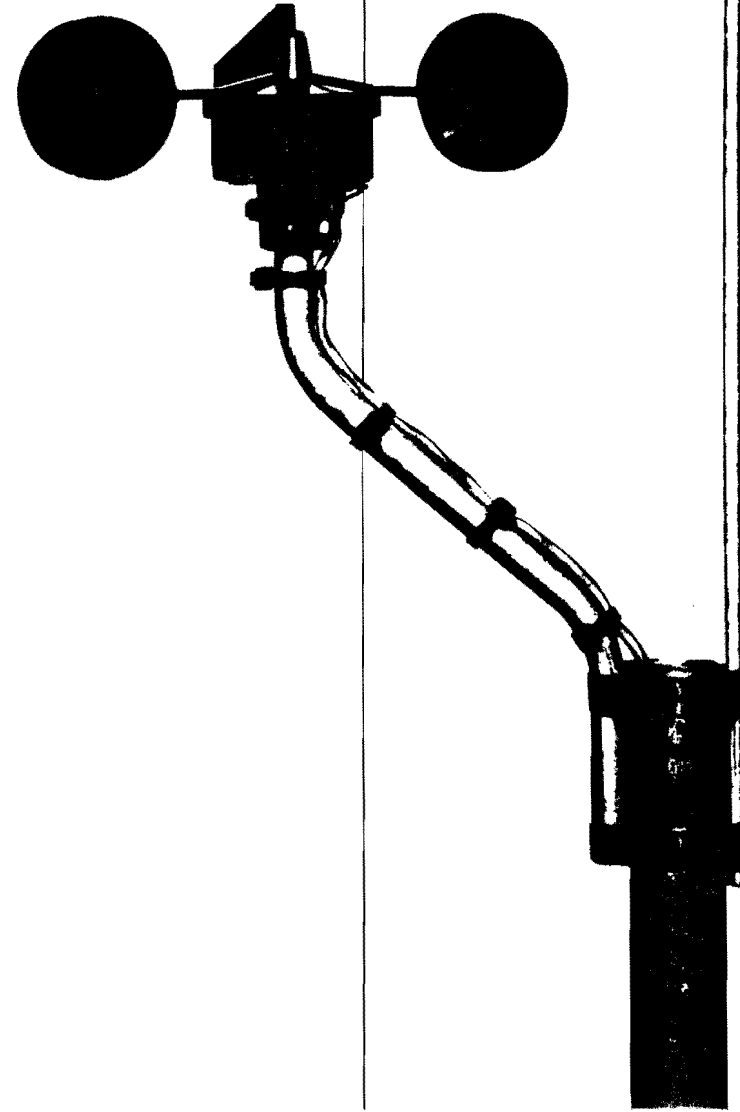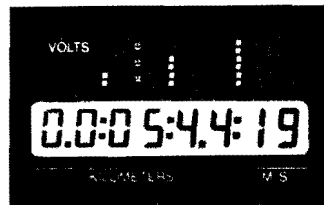
Totalizing Anemometer
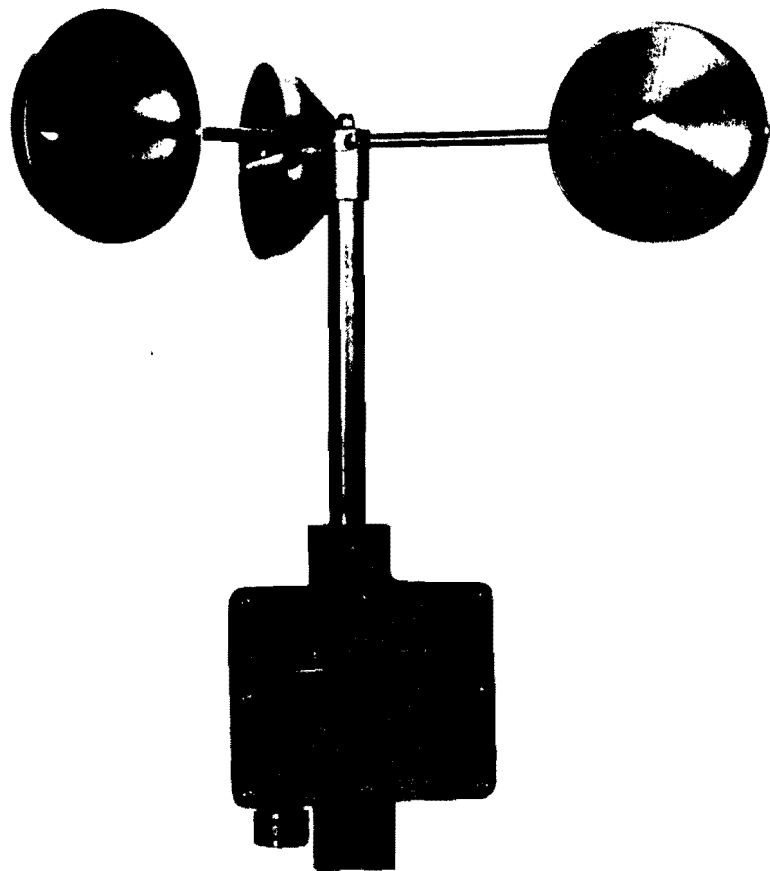
Cat. No. 5-349C

- ● Measures wind passage
- ● Supplied to measure in nautical miles, statute miles, or kilometers.

Totalizing Anemometer

The totalizing anemometer measures wind passage with both digital display and electrical pulse output. The instrument consists of a three cup rotor connected by a spindle and gear system to a five digit counter and two switches. The housing is an aluminum casting. The rotor is driven by the wind; the counter displays tenths and units of wind passage; the switches close momentarily for each unit and each 1/60 unit of wind passage.

The instrument is supplied to measure either nautical miles, statute miles or kilometers.

The unit switch is available in two forms; where the anemometer is to be used with the triple quadruple register, or the E-A type operat recorder, pins nine and ten are bridged so as give a longer closure signalling the passage of units of wind; for other applications, all pins alike and produce the same closure period.

The anemometer mounts on ½" IPS pipe pin for use in evaporation station the pintle fixes height of the cups 7" above the edge of the evap ation pan. Where mounting on a taper pintle is quired, adapter (#16699) is available.

SPECIFICATIONS

NET WEIGHT: 3 lb. 15 oz.
SHIPPING WEIGHT: 8 lb.
CONTACT RATING: 0.6 amps at 24 volts
        A.C./D.C.

SWITCH CLOSURE: each unit and 1/60
FINISH: Aluminum lacquer

ORDERING INFORMATION

EQUIPMENT DESCRIPTION	SPECIFY CAT. NO.
Counter and Contact with bridge	5-349C-1
Counter and Contact without bridge	5-349C-2
Counter Only	5-349C-3
Contact Only with bridge	5-349C-4
Contact Only without bridge	5-349C-5
*SPECIFY: Nautical Miles-N; Statute Miles-M; Kilometers-K; and whether taper adapter (#16699) is required.	

RELATED EQUIPMENT

Evaporation Station . . . . #6066
Pintle:
    Pipe . . . . #16802
Taper:
    Pedestal Type . . . . #2985
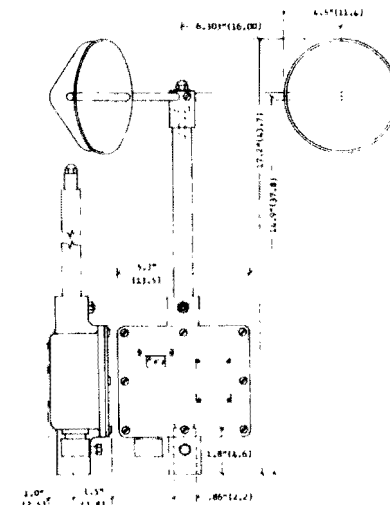
Cup Counter
Anemometer
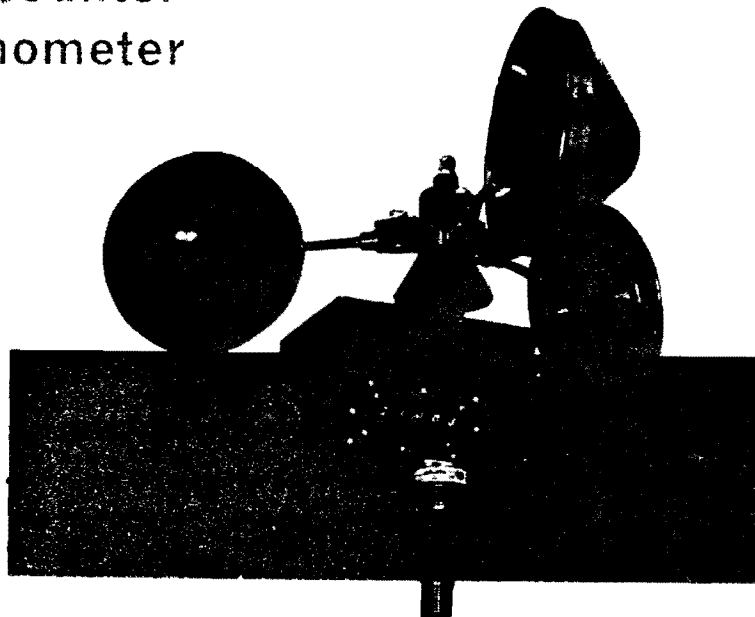
This instrument indicates on a mechanical counter the total run of wind past the observation point. By observing the counter reading at the beginning and end of any period of interest, the average wind speed during the interval can be calculated. The anemometer is made to a British Meteorological Office specification.

CONSTRUCTION

Three conical beaded-edged cups 5 inch (12·7 cm) in diameter, attached by arms to a central boss, drive a vertical spindle at a rotary speed proportional to the linear wind speed. The spindle is connected by worm gearing to a train of counters, the gear ratio being such that the counters indicate the linear run of wind directly in nautical miles, statute miles or kilometres. The counter wheels are made of a self-lubricating styrene-based plastic. The instrument terminates in an external ½-inch British Standard Pipe thread for screwing to a mast, and the counter observing window is angled downwards at 45° to facilitate reading from below or vertically for reading when the anemometer is sited close to an evaporation tank.

Brass, copper, stainless steel and plastics are used throughout the instrument to ensure freedom from corrosion and a long working life. The only maintenance required is annual lubrication of the top spindle bearing; all other bearings are self-lubricating. A conical shield protects the upper spindle bearing from rain.

GENERAL SPECIFICATION

Counter range 0 to 9999·99 nautical miles, statute miles or kilometres
Accuracy (wind speed) Better than 1 kt from 5 to 80 kt
Dimensions 12 in high × 9 in radius 30·5 × 23cm
Weight 8 lb 3·6 kg

CATALOGUE REFERENCES

Cup counter anemometer, British Meteorological Office pattern

W 1200/2 Inclined window, nautical miles
W 1204/2 Inclined window, statute miles
W 1208/2 Inclined window, kilometres
W 1220 Vertical window, nautical miles
W 1222 Vertical window, statute miles
W 1224 Vertical window, kilometres

Welcome to the world of the WP4A, the Wind Prospector that sets new standards for ease of operation and versatility
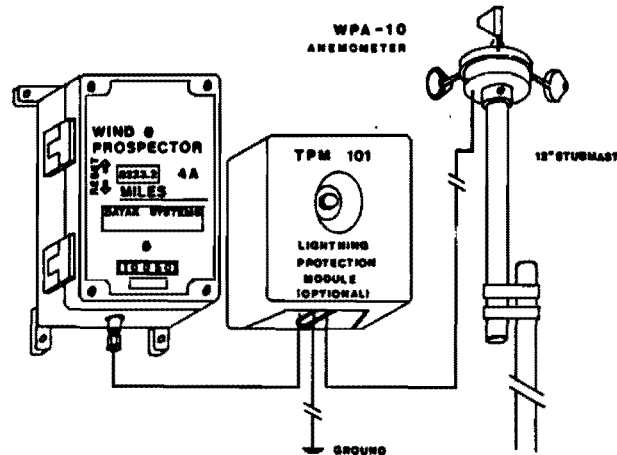
TYPICAL INSTALLATION

Design Excellence ...

The WP4A was designed with your needs in mind, and incorporates the same design standards reflected in Datak Systems' other sophisticated products for wind and solar research — systems employed by utilities, universities, and a wide range of research groups around the world.

Easy to Install!

The WP4A comes complete with:
25 ft. of shielded cable
1 ft. stub mast
1 desiccant capsule
1 magnetic reset key (odometer only)
External mounting brackets
Full instructions
6 month limited warranty

Easy to Operate!

The easy to read LCD display makes logging a breeze. All data is read through the transparent display window. A unique magnetically activated switch allows the display to be reset without opening the enclosure. Each WP4A can be factory programmed to display one of the following read-outs.

- MILES - KILOMETERS - KNOTS as an odometer, for short or long term measurements of average wind speed.
- Instantaneous read-out of MILES - KILOMETERS - KNOTS as a speedometer.

Easy to Maintain!

The WP4A is enclosed in its own waterproof enclosure and operates for up to two years using only four "AA" alkaline penlight batteries. Desiccated with a replaceable indicating silica gel capsule that can be viewed from its own window located below the large, easy to read serial number.

High Reliability!

Extensively field tested, the WP4A can operate in the harshest of environments. Every unit is calibrated, computer tested, and is run for 48 hours before leaving the factory to insure reliable long term operation.

SPECIFICATIONS:
Size and weight: 3.5" x 2.3" x 6.25" — 13.5 oz.
Operating temperature: -30° F to 158° F
Power: 4 "AA" alkaline batteries provide 2 years operation — polarity protected (batteries not included)
Display: 6 digit LCD
Odometer: 1/100 to 9.999.99 units
1/10 to 99,999.9 units
Speedometer: 0 - 100 MPH.
0 - 160 KPM.
0 - 87 Knots
Anemometer: 3 cup polycarbonate
Threshold: 2 - 3 MPH.
TPM 101: Response time less than 10^{-12} seconds - discharge current 200 Amps per line.

PRICE AND ORDERING INFORMATION

Odometer	☐	(Check One)
Speedometer	☐	
Read-out		(Check One)
MPH	☐	
KPH	☐	
Knots	☐	
Odometer only		
Read-out units		(Check One)
1/100 to 9,999.99	☐	
1/10 to 99,999.9	☐	—

WP4A	$275.00	☐
100 ft. shielded cable	15.00	☐
50 ft. shielded cable	10.00	☐
4 "AA" alkaline batteries	7.50	☐
Replacement desiccant capsules (each)	3.00	☐
TPM 101	70.00	☐
Replacement fuses for TPM 101, box of 5	10.00	☐
Additional reset keys	1.00	☐

All Prices in U.S. Dollars

Windmeters van EKOPOWER
nauwkeurige apparatuur voor:

* METEOROLOGIE   * MILIEUTECHNIEK   * WINDENERGIE   * SCHEEPVAART
* ZEILEN EN SURFEN   * (ZWEEF)-VLIEGEN   * EDUKATIE   * ONDERZOEK

EKOPOWER heeft een doordachte serie windmeters ontwikkeld met vele mogelijkheden voor een aantrekkelijke prijs.
De kwaliteit en nauwkeurigheid van de instrumenten

voldoen ruimschoots aan de internationale normen van de Wereld Meteorologische Organisatie (WMO) en van de International Energy Agency (IEA).
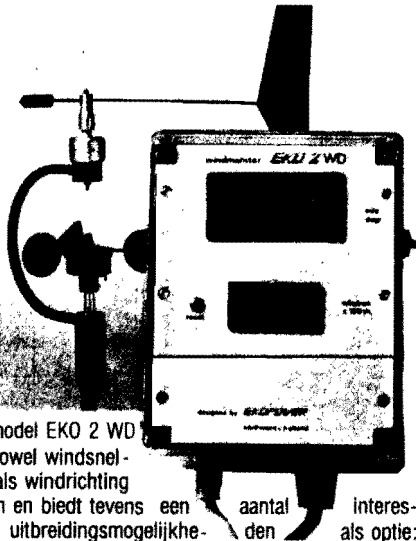
Het model EKO 2 WD kan zowel windsnelheid als windrichting meten en biedt tevens een aantal interessante uitbreidingsmogelijkheden als optie:
* windrun (voor de bepaling van gemiddelde snelheid en windkracht volgens de schaal van BEAUFORT)
* max. windsnelheid
* recorder uitgang
* windalarm

De EKO 2 WD kan zelfs worden uitgebreid tot WEERSTATION door ook temperatuur en vochtigheid te meten. De meetgegevens worden van een Liquid Crystal Display (LCD) afgelezen.
Het apparaat is in een kleine waterdichte kast gebouwd en kan gevoed worden met 12 tot 24 volt DC of 220 volt AC.
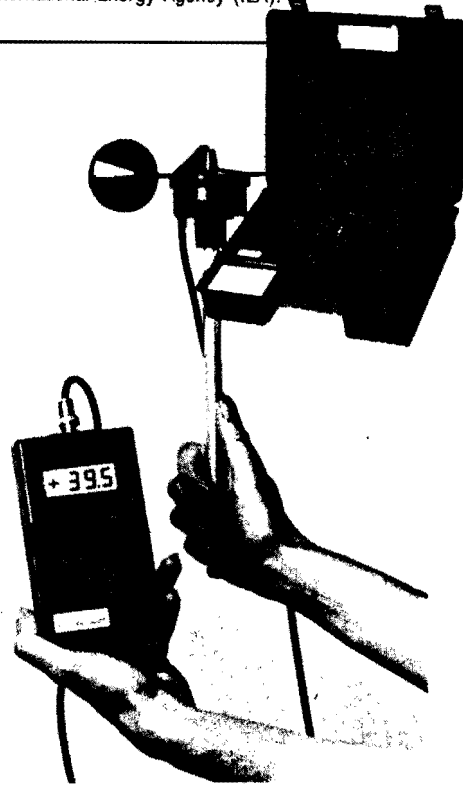
Het model EKO 2A is een geavanceerde draagbare handwindmeter met mikroprocessor besturing. Met dit instrument kan zowel de momentane als de gemiddelde windsnelheid worden gemeten en tevens kan de windkracht volgens de schaal van Beaufort worden bepaald.

andere EKOPOWER produkten

Naast diverse typen windmeters (waaronder batterijgevoede en/of tropenbestendige typen voor veldmetingen) levert EKOPOWER ook luchtsnelheidsmeters, dataloggers-systemen en instrumenten voor professionele toepassing op het gebied van meteorologie en milieu-

techniek in binnen-en buitenland. Tevens ontwikkelen wij apparatuur volgens uw specificaties.
Het standaard produktoverzicht voor windmeters vindt u hieronder:

standard-products overview

FUNCTIONS	TYPE EKO:										
	2A	2W	2WD	2F	2S	2U	2C	3N	10A	10B	10C
WINDSPEED or AIRFLOW											
-instantaneous indication	■	■	■	□	□			□	□	□	
-voltage output		□	□	□	□	■		□			
-current output							■				
-average speed	■							■	■	■	■
-windrun	■	□	□	■				■			
-windclasses								■			
-maximum gust		□	□	□				□	□	□	
-setpoint (windalarm)		□	□		■						
-operation time				□				■	■	■	■
-datalogging (sequential)									■	■	■
WIND DIRECTION											
-instantaneous indication			■								
-voltage output		□				□					
-current output							□				
-average										■	■
WIND POWER (according to IEA recommendations)											
-power (output of WECS)											■
-windspeed											■
-winddirections											■
-airdensity											■
FIELDPROOF & TROPICALIZED				■				■	■	■	■
PORTABLE & BATTERY POWERED	■			■				■	■	■	■

■ = standard function   □ = option

FOR DETAILED INFORMATION ASK FOR OUR PRODUCT-DATASHEETS

EKOPOWER

WINDMONITOR EKO 2F

Windmonitor EKO 2F has been designed for the determination of short and long term average wind speeds at remote sites. The instrument is standard fieldproof and tropical resistant.

Typical applications are:

* simple feasibility studies for wind power
* environmental studies

FEATURES:

* battery powered
* ultra low power
* meets WMO/IEA accuracy
* waterproof cabinet
* tropicalized

STANDARD FUNCTION:

* windrun

OPTIONS:

* instantaneous wind speed
* operation time counter
* max. gust memory
* recorder output
* other type anemometer

READ OUT: windrun/ time counter : standard electromechanical counters;
                                   optional LCD-counter
(optional) windspeed indication : analog meter   (scale 0-30   m/s)
                                   LCD or LED display (range 0-50,0 m/s)
ACCESSORIES: longer sensor cable, cable connectors, weatherscreen,
(not standard)   alkaline-, lithium- or NiCd -batteries, additional recorder
                  or datalogger.

SPECIFICATIONS:

batteries	: 6, type IEC LR 6 (1,5 V) (alkaline AA cells)	cabinet 2)	:waterproof, IP 557 polycarbonate
battery life	: at least 6 months		transparant front
accuracy	: -speed typ. 0,2 m/s (v>1 m/s) -windrun typ. 1% of reading (meets WMO/IEA standard)	dimensions rec. output	170x130x85 mm :2 V DC at 30 m/s 3)
windrun	: 7 digit non-volatile counter each 100 meter one count	analog meter weight environmental (electronics):	:class 1,5 :appr. 1 kg
max. gust	: resolution 0,2 m/s		
operation time	: 7 digit nonvolatile counter each minute one count	temp. range -standard	: - 25 to +65 C
anemometer 1)	: MAXIMUM	-meter/LCD	: - 10 to +50 C
sensor cable	: 10 meter (longer possible)	-LED	: - 10 to +60 C
input protection:	solid state	humidity	:max. 100 % with
guarantee	: one year		condensation, meets IEC 68-2-30

1) separate datasheet available   2) mounting brackets included
3) other value on request

EKOPOWER reserves the right to change specifications without notice

For general information about other EKOPOWER products please refer to :
* Guide to products, services and applications
* Introduction to measurements of windspeed and windpower

WIND DATA ACCUMULATOR

AN ACCUMULATOR records the total passage of wind, showing calculation of the *average wind speed* — the most common measurement used for windmill siting.

The A21/22 Series provides:

- **Long term average wind speed.** A basic measurement commonly used for preliminary site analysis.

- **Low cost, high reliability wind analysis.** Computer aided testing for the ultimate in reliability and cost effectiveness.

- **Indoor or outdoor operation.** Engineered for harsh, remote operation. Useful in any environment. Your choice of power sources: alkaline or lithium battery, 120 or 240 VAC line.

The anemometer head sends wind speed information as a variable frequency AC signal to the Accumulator.

The input is protected against lightning induced line surges and high-static potentials. The circuitry permits separation of several thousand feet between the sensor and the calculating unit.

The Accumulator translates the anemometer signal into distance units equaling 1/60 mile. Upon command the display indicates the number of units counted ("accumulated") during the test period. Dividing that number by the number of minutes in the test period yields the average wind speed.

- Average wind speed (mph) =
$$\frac{\text{display number}}{\text{time of test (in minutes)}}$$

- Current wind speed = number of counts in 1 minute

- Wind Run (Miles of Wind) =
$$\frac{\text{display number}}{60}$$

The current wind speed may be monitored by taking two consecutive readings 1 minute apart. The number of counts during this minute is the current average wind speed.

The memory may be erased to begin a new test period by momentarily turning the power off, or a running total may be monitored.

Model A21 Indoor Accumulator comes complete with an internal nickel-cadmium battery which is maintained in a charged state by the recharger/AC adapter (iincluded). These Ni-Cd batteries will run the Accumulator for up to several days if the AC power source should fail. Longer periods of unattended battery operation can be achieved through the use of an external battery of greater capacity connected through the power jack. This instrument is housed in a miniature instrument case for display in benign environments.

Model A22 Outdoor Accumulator is for unsheltered, remote installation. The outdoor enclosure is engineered for harsh environments, protecting against rain, sleet, snow, dust and salt conditions, and includes provision for locking. Using alkaline or lithium 'C' size battery cells, the A22 provides years of trouble-free operation. Standard alkaline batteries are suitable where temperatures do not fall below freezing. Lithium cells are recommended specifically for long shelf life and low temperature operation. The A22 comes complete with A75-104 Anemometer Head and 60 feet of interconnecting cable.

Natural Power Inc.
Specialists in Electronics for the Renewable Energy Industry

FRANCESTOWN TNPK, NEW BOSTON, NEW HAMPSHIRE 03070 603-487-5512

Specifications subject to change.
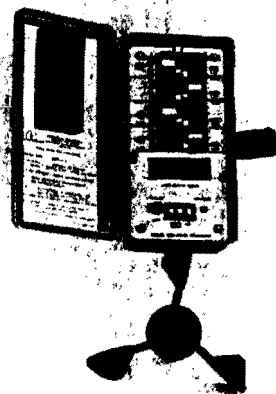
WIND INSTRUMENTS **SERIES A21/22**

SPECIFICATIONS

Operating Power: Model A21, 115 VAC or 240 VAC, 50-60 Hz adapter, specify at time of order.
Model A22, Alkaline C cell (4 required) *OR* Lithium C cell (2 required, NPI A90-003C). Batteries are not included.

Input Devices: A75-104 cup anemometer (included).

Display: 7-digit LED (9,999,999).

Controls: Power ON/OFF (reset); Display.

Accuracy: Anemometer, ± 5% of reading, 10-100 mph.

Resolution: 1/60 mile of wind.

Response Time: see sensor spec.

Unattended Operating Period: 1,600,000 miles of wind approx.
Model A21, 12 hours backup power.
Model A22, 1 year alkaline battery life *OR* 2 years lithium battery life.

Ambient Instrument Temp. Range:
Model A21, 0 to 60°C.
Model A22, – 40 to 60°C.

Environmental Protection:
Model A21, none, requires shelter.
Model A22, suitable for unsheltered operation; lightning protection on anemometer input line.

Dimensions:
Model A21 — 4"w × 2"h × 4½"d.
Model A22 — 5½"w × 10½"h × 3½"d.

Weight: Model A21 — 1½ lbs.
Model A22 — 3 lbs.

Connectors: Model A21, RCA type phone jack; two-prong plug on charger. Model A22, terminal strip.

Special Requirements: External lightning arrestor recommended for sensor protection.

WIND INSTRUMENTS **SERIES A21/22**

NRG Systems

We're dedicated to making wind power work for you.

The manufacturing of wind instruments and related equipment is our only business. And we take it very seriously. An NRG instrument must be accurate, and it must be dependable. So our designs are careful and thorough, we stay on top of innovations in the field, and our instruments are fully field-tested. If your serious about an investment in wind power, begin with precision instruments from NRG.

Careful siting is the key to wind power success. NRG can help.

A careful analysis of your site can help you avoid unpleasant surprises in the future. NRG's instruments allow you to precisely predict wind power performance *before* you invest in expensive equipment...and after installation, they'll keep your wind system running efficiently.

Whenever wind is at work, NRG precision and durability can help. These instruments are ideal for wind-site surveys for residential, farm, and small business wind power applications, including wind turbines. Wind turbine owners will find them invaluable for monitoring turbine generation, power production and wind variations. They're also useful in tracking wind farm operations. And more.

Wind power can be a wise investment, if you approach it wisely. Before you leap, look to NRG.

Quality and durability you can count on...precisely.

We take great pride in the precision and overall high quality you'll find in every NRG instrument. Each unit features extremely accurate digital or microprocessor electronics that will provide continuing operation and data retention even during power failures. The wind-tunnel tested sensor is one of the market's most reliable. And each indoor model features a unique, handcrafted solid mahogany case (outdoor models feature fiberglass weatherproof enclosures.)

And to make sure you get the most out of your NRG's instrument, each unit is covered by a full one-year limited warranty and the support of a growing worldwide dealer network.

Contact us for the NRG dealer nearest you.

NRG Systems
Church Hill Road
Charlotte, Vermont 05445
(802) 453-4662

WIND CHALLENGER
WIND EXPLORER

The unique Wind Challenger #7010 is the newly updated version of NRG's pace-setting model 7000. Some of the refinements in the new state-of-the-art 7010 include: Wind Power Density (watts/meter squared) recalculated with each new sample; Hour of Peak Wind Gust readings; user-selectable cut-in windspeed; lull set point and units; duration of longest "energy lull", and more...8 functions in all. Features a rugged, weather-tight fiberglass enclosure with stainless steel latches and hardware. Complete with 3-cup sensor, 60' cable, stub mast, battery and instructions.
PRICE: $450

MODEL NO. 5000

#5000
- Present Windspeed—updated every second
- Total Average Windspeed—true average calculated from wind run
- Total Elapsed Time—hours since reset
- Average Windspeeds (for day, week or month)—stores nine daily, weekly or monthly averages for later display

NRG's Wind Explorer #5000 collects, stores and displays present and average windspeed and time. It can be set to start recording nine daily, weekly, or monthly averages at any time, as well as recording the total average windspeed and total elapsed time... 12 data points in all, without you being there! The Wind Explorer requires very little power (6 months of operation on one 9-volt alkaline transistor battery), has an ultra-wide temperature range (-40°F to 160°F) and features our rugged fiberglass and stainless steel enclosure. Includes 3-cup sensor, 60' cable, stub mast, battery and instruction.
PRICE: $360

MODEL NO. 7010

#7010
- Present Windspeed—updated every second
- Peak Wind Gust—up to 218 mph
- Average Windspeed—true average calculated from wind run
- Power Density (W/M)—actual wind energy measured (V cubed)
- Elapsed Time—hours since reset (0.0-9999 hrs.)
- Hour of Peak Wind Gust—time gust occurred
- Cut-In Speed/Hours Above Cut-In—user selected
- Duration of Wind Energy Lull—continuous hours below 6 mph

WIND TOTALIZER
CHINOOK

The Wind Totalizer #2800 is our newly updated version of the popular #280 totalizer. The 2800's internal lithium battery is an industry first, providing 10 years or more of operation without changing batteries. Total wind run is the most economical method of averaging wind speeds—important data in predicting the energy output of a wind system. The 2800 displays present wind speed with a blinking colon (:) (blink rate equals wind speed). Fiberglass enclosure is weathertight, with stainless steel latches and hardware; comes complete with 3-cup sensor, 60' cable, stub mast and instructions.
PRICE: $260

MODEL NO. 100

#1000
- Present Windspeed
- Peak Wind Gust
- Elapsed Time
- Hour of Peak Gust

NRG's Chinook #1000 is the update of our C100 wind speedometer. Using the latest microprocessor technology and new materials, the Chinook features more functions at a low price. It measures and displays present windspeed, measures and stores peak wind gust, elasped time and hour of peak gust. A battery back-up prevents memory loss during power outages, front panel reset button is recessed to avoid accidental resets. The Chinook features our beautiful solid mahogany wood case with clear laquer sealer, and comes complete with 3-cup sensor, AC adapter, 60' cable, stub mast and instructions.
PRICE: $225

MODEL NO. 2800

#2800
- Displays Total Wind Run—to 10,000.0 miles (.1 mile increment)
- Displays Windspeed With Blinking Colon (:)—blink rate equals windspeed

---

FOR SPECIFICATIONS AND OPTIONS, SEE BACK PANEL

Parkway Energy Products

22 Parkway Road, Suite 2
Brookline, MA, 02146 USA   (617) 731-8361

PARKWAY'S WIND RUN ACCUMULATOR

This attractive low cost, multi-digit resettable counter
and complementary contact anemometer provides you with
the total mileage and hence average wind speed at your
site and the instantaneous fastest mile of wind to pass.
Intended to operate in your home, a six-digit remote
battery operated version is available which may be left
unattended at strong wind sites for one month intervals.
Three year batteries, wire and mounting hardware included.
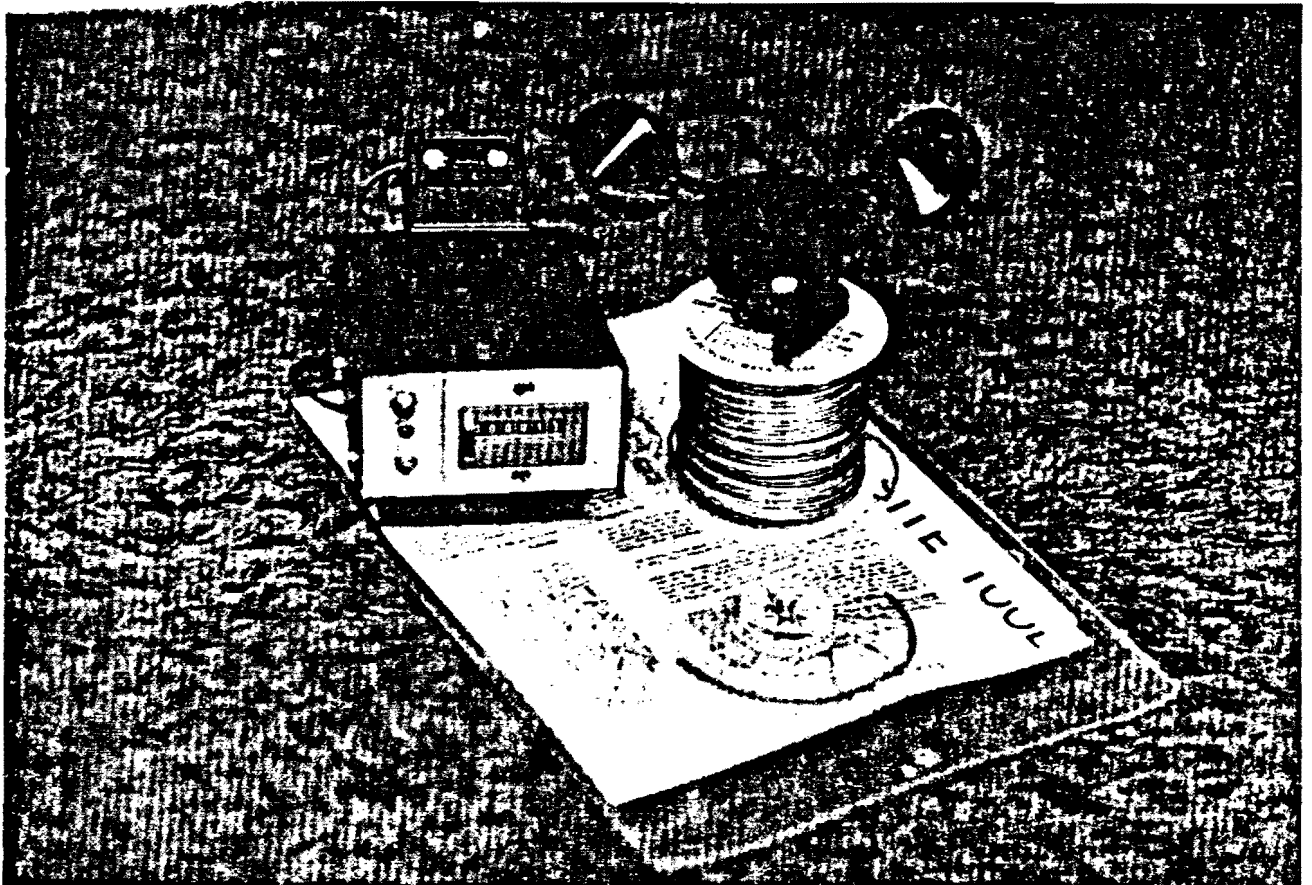
SUMMIT CONTROLS CORPORATION

MODEL WGC-100 WIND RUN TOTALIZER SYSTEM

AVERAGE WIND SPEED/TOTAL WIND

The WGC-100 Wind Run Totalizer is an outdoor instrument which records total wind at remote locations. The unit is an essential tool for surveying prospective wind energy conversion sites. When used alone or in conjunction with other recording instruments, the WGC-100 provides a reliable, low-cost method of measuring long-term average wind speed and total wind. The unit can operate for one year from its battery pack, and is impervious to even severe outdoor conditions.

Wind speed is detected via a 3-cup magnetic anemometer, which provides an electrical frequency proportional to wind speed. This data is accumulated in an 8-digit counter and continuously displayed on the ½" high LCD readout. The average wind speed and total wind can be calculated from the wind run total, according to the following equations:

average wind speed (MPH)
= wind run total x 1.7 / time (seconds)

total wind (miles) = wind run total / 2117

The total count can be reset by momentarily removing the battery pack.

The totalizer is a hermetically-sealed module, as is the battery pack, allowing the unit to withstand outdoor environments without the need for shelter or enclosure. Because there are no pushbuttons, switches, or doors, the system reliability is optimized. The WGC-100 system is shipped as a complete package, including totalizer, anemometer, cable, battery pack, and mounting hardware. The Summit Controls standard one-year warranty applies to this product.

FEATURES:

o Weather-tight, totally encapsulated

o Plug-in battery pack, one year operation

o Average wind speed, total miles of wind

o 8-digit display, ½" high

o Continuous display

o No buttons, switches, or doors

o Complete package, ready to install
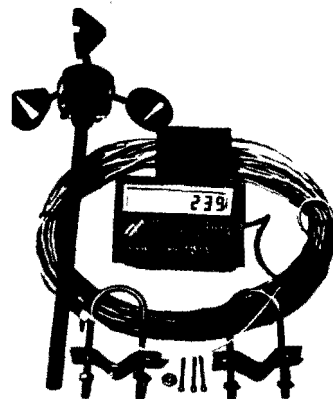
MODEL WGC-100   (all dimensions in inches)

TOTALIZER MODULE   55' cable

battery pack

4.50   1.00   .80

3.00   2.50

.70   3.10   1.25

front view   mounting screws   side view
#6-32 stainless
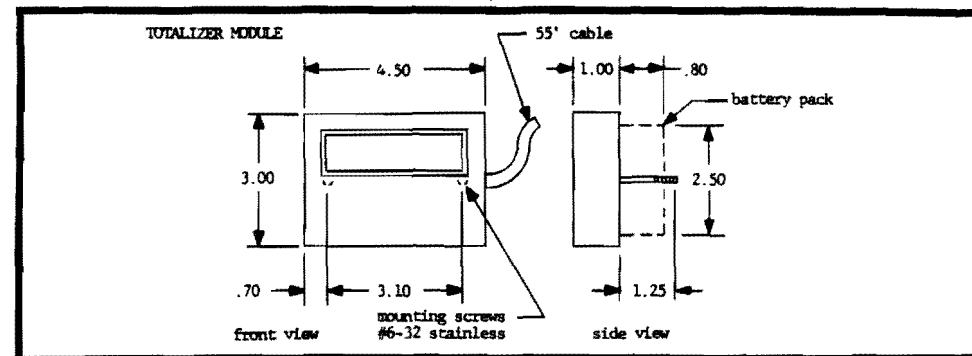
SPECIFICATIONS:

Power Requirements: (one-year operation)
one model WGC-521 sealed battery pack
(included with system)

Sensors/Transducers:
one model WGC-212 3-cup magnetic anemometer with variable frequency output,
MPH = frequency x 1.7
(included with system)

Data Accumulation:
Display: ½" 8-digit liquid crystal display (to 99,999,999)
Reset: to reset total, remove battery pack
Scaling: average wind speed (MPH)
= Wind Run x 1.7/time (seconds)
miles of wind = Wind Run/2117
Speed range: 0 to 100 MPH

Operating Temperature: -20 to 160 degrees F.

Terminations:
two-wire cable with circular lugs
55' of cable supplied with totalizer

Housing: Weather-tight, totally encapsulated

Weight: 3 lbs., complete package

ORDERING INFORMATION:

Model WGC-100 Wind Run Totalizer System
(includes WGC-321 8-digit totalizer with 55' of cable and preassembled lugs, WGC-521 sealed battery pack with batteries, WGC-212 magnetic anemometer, 12" anemometer post with mounting hardware)

accessories:

Model WGC-521 Sealed Battery Pack

SUMMIT CONTROLS CORPORATION
1215 HIGH ST., SUITE 103
AUBURN, CALIFORNIA 95603
PHONE (916) 823-9329

TOTALIZING ANEMOMETER
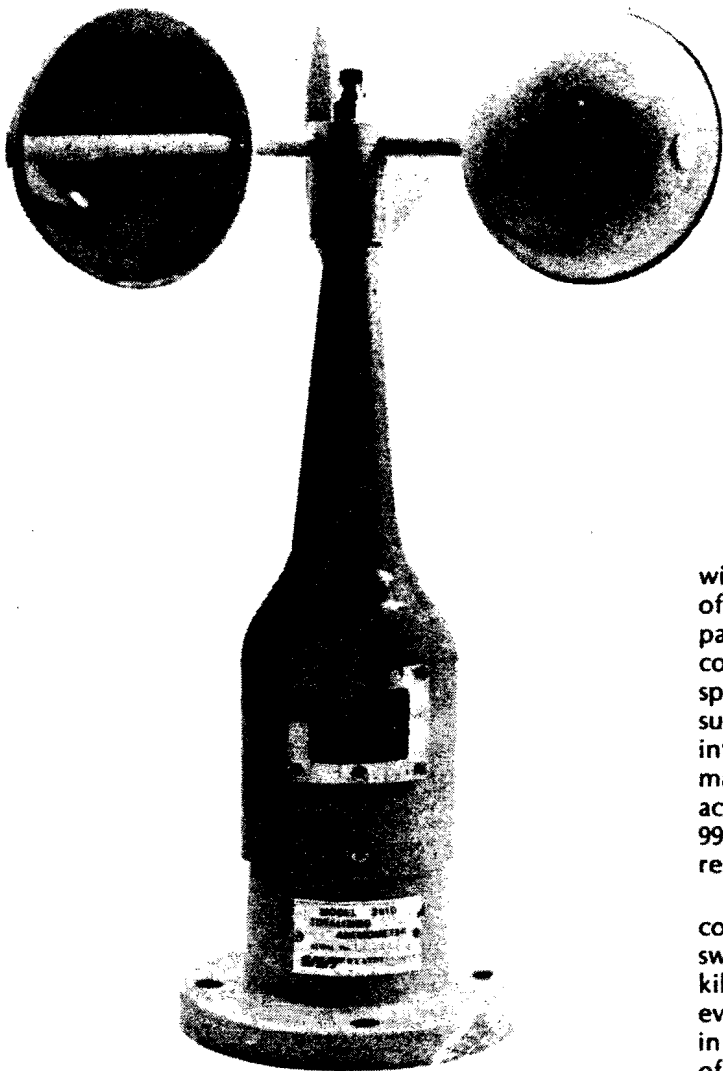
■ 6-digit mechanical counter
■ Electrical contact output
■ English or metric models
■ Predrilled mounting base

The Model 2510 totalizing anemometer is equipped with a counter to provide a simple, yet precise, method of determining average wind speed and total air passage. An internal gear train converts cup rotation to counter input (869 revolutions per mile). Average wind speed can be calculated from the difference between successive counter readings divided by the time interval between readings. The 6-digit counter is not manually resettable. The anemometer can typically accumulate wind run for a year or longer (up to 99,999.9 miles or kilometers) before automatically resetting to zero.

The totalizing anemometer also provides an electrical contact output by means of a magnet-activated reed switch. The switch furnishes one closure per 0.1 mile or kilometer. This contact can be used to advance an event recorder or a remote digital counter (described in detail in the Precipitation section). A 33-foot length of 2-conductor cable is included to make the necessary connections.

The 4-inch-diameter brass cups have a threshold of approximately 1 mph. The cups are beaded and are attached to the hub by sturdy arms. The turning radius is 6 inches. Self-lubricating stainless steel bearings support the anemometer shaft.

The flanged base of the instrument is predrilled, permitting mounting on a wooden, metal, or concrete support. In an evaporation station the anemometer is typically mounted on the platform supporting the evaporation pan. A mast adapter is available for mounting to a 1.5-inch (38 mm) O.D. mast.

SPECIFICATIONS

Sensor	3-cup assembly, brass, 4" dia. cups
Transducer	Spindle and gear train
Output	Counter increment and reed switch closure
Counter type	6-digit mechanical
Counter range:	
Model 2510	0 to 99,999.9 miles
Model 2511	0 to 99,999.9 km
Contact rating	0.4 A at 24 VDC resistive load
Resolution (counter and contact)	0.1 mile or 0.1 km
Sensor range	0 to 100 mph
Threshold	1 to 2 mph
Cup constant	869 revolutions/mile, 540 revolutions/km
Materials	Cast aluminum and brass
Mounting	Predrilled flanged base
Size	12" dia. × 16" H (305 × 400 mm)
Weight/shipping	5 lbs./9 lbs. (2.3 kg/4 kg)

ORDERING INFORMATION

Model
2510 Totalizing Anemometer with Electrical Contact, output in miles; includes 33' (10 m) of cable
2511 Totalizing Anemometer with Electrical Contact, output in km; includes 33' (10 m) of cable
25101 Mast Adapter to mount 2510 or 2511 on 1.5" (38 mm) O.D. mast
T600502 2-conductor, 20 AWG shielded cable

CLASS III:

Manufacturer	number of pages
Berewoud Energie	1
Datak Systems	1
Ekopower	1
Environdata Australia	1
G.T.S.	1
M.A.N.	1
Northumbrian Energy Workshop	2
NRG Systems	1
Parkway Energy Products	1
Secondwind Al-2000	2

Wind classifier I   (scientific version)

* 20 wind classes from 0 to 20> m/s
* 2 x 8 calm duration classes or diurnal pattern over 20 days
* maximum wind velocity
* time of measurement
* data output by Kansas City Standard Interface to cassette recorder or printer
* actual wind speed every minute by display

Wind classifier II   (standard version)

* 20 wind classes from 0 to 20> m/s
* 1 x 8 calm duration classes
* maximum wind velocity
* average wind velocity
* actual wind speed every minute by display

Wind classifier III   (home model)

* 23 wind classes from 0 to 23> m/s
* 1 x 8 calm duration classes (freely programmable)
* maximum wind velocity
* average wind velocity
* time of measurement
* maximum lull duration time
* actual wind speed every minute by display
* data output by printer automatically in a preprogrammed interval or by pressing the key CL

Hardware

* watertight housing
* ambient temperatures – 20° C .. + 70° C
* quartz-controlled time base
* exceptionally easy handling by magnetic reed contacts
* battery change after up to 1 year – normally once a 1/2 year (depends on what kind of batteries are being used)
* liquid cristal display allows operation checks, delivers data output and offers the actual wind speed every minute.

All Wind classifiers are supplied complete with anemometers, a set of batteries for one year and the requisite post-bracing facilities.

Supplementary units

The following optional extras are available:

Interface
Printer
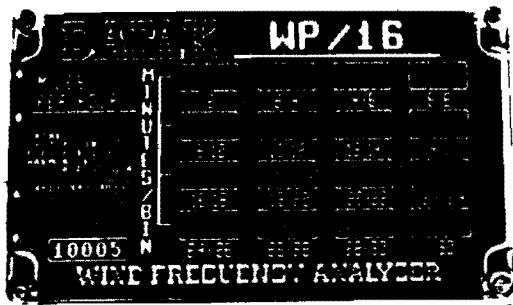
WIND PROSPECTOR 16
6 BIN WIND FREQUENCY ANALIZER

FEATURES:

- Battery operated
- Waterproof-desiccated enclosure
- Magnetically activated display latch and reset swiches
- Low temperature operation
- Instructions-anemometer with 50 ft. of connecting cable-1 ft. stub mast-6 month limited warranty included
- Optional lightning protection available (TPM-101)

FACTORY PROGRAMMABLE
- Bin width
- Time in minutes
- Time in seconds
- Miles
- Kilometers
- Dead bin

SPECIFICATIONS:
Size and weight: 8.8"x4.6"x3.0" 2 Lbs.
Operating Temp: -30° F to 158° F
Power: 4 "C" Alkaline batteries provide 1 year operation-polarity protected (batteries not included)
Display: 6 Digit LCD x 16
Time Base: Quartz crystal accurate to +/- 2 seconds/day
Enclosure: Polycarbonate
Anemometer: 3 Cup Polycarbonate
Threshold: 2-3 MPH

WP/16 PRICE $725.00
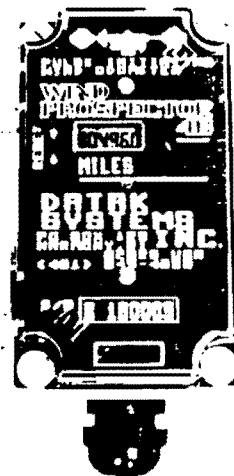
WIND PROSPECTOR 4B
PULSE INITIATING WIND ODOMETER

FEATURES:

- Battery operated
- Waterproof-desiccated enclosure
- Magnetically activated reset switch
- Low temperature operation
- Instructions-anemometer with 25 ft. of connecting cable-1 ft. stub mast-6 month limited warranty included
- Optional lightning protection available (TPM-101)
FACTORY PROGRAMMABLE
- Miles
- Kilometers

SPECIFICATIONS:
Size & weight:5.9"x3.2"x3.1" 13.5 oz.
Operating Temp.:-30° F to 158°F
Power: 4 "AA" Alkaline Penlight batteries provide 1 years operation-polarity protected (batteries not included)
Display: 6 Digit LCD
Output: Fora C Mercury Wetted Relay (KYZ)
100 Transitions/Unit
10 Transitions/Unit
(same as display)
Enclosure: Polycarbonate
Anemometer: 3 Cup Polycarbonate
Threshold: 2-3 MPH

WP/4B PRICE $335.00

EKOPOWER

Monarchstraat 46
5641 GJ Eindhoven
Holland
Tel.: 040 - 81 44 58

W I N D R E G I M E -
A N A L Y Z E R   E K O   3 N

Windregime-analyzer EKO 3N has
been designed for the determi-
nation of the frequency distribu-
tion and average wind speeds at remote sites.
This fieldproof instrument is standard
tropicalized.
The control and the readings
are very simple; there is no need for
training the user.

The EKO 3N can be used for:
- output predictions of wind energy systems
- choosing the most suitable windturbine
- feasibility studies for wind power
- site analysis for wind power
- simple (wind)power performance evaluation
- determination of Weibull parameters
- meteorological and environmental studies
  (e.g. air pollution).

For application notes refer to our leaflet
"Introduction to measurements of wind speed
and wind power".

The used windclass-counters are non-volatile,
so the collected data will not be lost when
the batteries are exhausted or disconnected.
EKOPOWER can assist you for processing the
collected data.

FEATURES:
* battery powered
* ultra low power
* meets WMO/IEA accuracy
* non-volatile memory
* waterproof cabinet
* tropicalized

STANDARD FUNCTIONS:

* recording frequency dis-
  tribution of windspeed in 7 wind-
  classes (bins)
* windrun counter
* operation time counter

OPTIONS:

* number of windclasses 10 or
  13
* instantaneous wind speed
* max. gust memory
* recorder output
* other type anemometer
* 220 V AC supply voltage

READ OUT:(optional) windspeed indication: analog meter (range 0-30   m/s) or
LCD or LED- (range 0-50,0 m/s)

ACCESSORIES: sensor cable, cable connectors, weather screen,
(not standard) alkaline- ,lithium- and NiCd- batteries, additional recorder
                or datalogger.

p.t.o.

EKOPOWER

SPECIFICATIONS EKO 3N

- batteries   : 6 type IEC LR 6 (1,5 V), alkaline (AA cell)
- battery life   : at least 6 months
- windspeed display : range 0...50 m/s (LED or LCD display); 0..30 m/s
                       (analog meter, class 1,5)
- accuracy   : -windspeed
                        typical deviation 0,2 m/s (v > 1 m/s) ; meets
                        the standards of WMO and IEA (refer to our leaflet
                        "Introduction to measurements of windspeed and windpower"
                       -windrun typical 1 % of reading (v> 1 m/s)
                       -operation time counter: several seconds a month
                        (quartz controlled)
- max. gust memory   : range 50 m/s; resolution 0,2 m/s
- windrun   : 5 digit non volatile counter, each 100 meter 1 count
- operation time 1) : 5 digit non volatile counter, each 10 min. 1 count
- windclasses   2)   : windclass nr.   windspeed interval (m/s)

windclass nr.	windspeed interval (m/s)
1	0 - 4
2	4 - 6
3	6 - 8
4	8 - 10
5	10 - 12
6	12 - 14
7	> 14

- sample time   3) : (time over which the windspeed is averaged and classi-
                      fied in windclass counter) : 10 minutes (standard)
- anemometer   4) : MAXIMUM
- anemometer cable : 10 meter; longer possible
- cabinet   : waterproof, IP 557, polycarbonate with transparant
                      front and mounting brackets
- dimensions   : 170x130x85 mm (standard)
                      245x130x85 mm (with option 10 or 13 windclasses)
- weight   : appr. 1,5 kg.
- environmental   : temperature range: -25 to + 65 C (standard)
                                          -10 to + 60 C (with LED display)
                                          -10 to + 50 C (with LCD display or
                                                          analog meter)
                      humidity : max. 100 %, with condensation
                      (meets IEC 68-2-30)
- recorder output   : 2 volts at 30 m/s
- transient protection: solid state
- guarantee   : one year

   1) The operation time counter is activated after each sample time; the
      standard value is 10 minutes, see also note 3.
   2) The windspeed intervals of the windclasses may be specified at order,
      the number of windclasses can (optionally) be increased to 10 or 13.
   3) The sample time can be adjusted (at factory) between 1 and 60 minutes
   4) separate datasheet available; if desired other type possible

EKOPOWER reserves the right to change specifications without notice

For general information about other EKOPOWER products please refer to the
"Guide to products, services and applications"

ENVIRONDATA AUSTRALIA PTY. LTD.

P.O. BOX 395, WARWICK, QUEENSLAND, AUSTRALIA. 4370 PHONE: (076) 61 4450 TELEX AA44815

A N A R E C

ANEMOMETER ANALYSING RECORDER

GENERAL

This low cost recorder has been designed by the University of Queensland to produce a simple monthly summary of Average Wind Speeds and their durations. An average is measured over a one hour period and converted into one of 18 wind speed ranges. The recorder is used with a commercially available anemometer which closes a contact every 1/60th mile of wind-run.

FEATURES

Battery Powered - Operates unattended for 5 weeks

Two readout displays from a four digit display can be read anytime.

    Simple Display   - gives an 18 value summary for the 5 weeks to
                        enable the graph overleaf to be drawn.

    Detailed Display - gives the average windspeed for each hour
                        covering the full 5 weeks.
                        This data can be read manually or transferred to
                        an Apple computer using programs written in the
                        "Pascal" language.

APPLICATIONS INCLUDE:

- FEASIBILITY STUDIES for wind generation
- BEST LOCATION for wind generators/windmills
- WIND ERROSION STUDIES
- AIR POLLUTION STUDIES
- CLIMATIC STUDIES
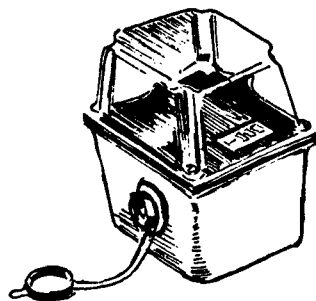
OPERATION

Recording is commenced by plugging the Anemometer into the Recorder and is stopped by disconnecting the Anemometer from the Recorder. If the Anemometer is not reconnected within the next hour, the ANAREC will enter a dormant or "sleep" mode. This mode is a low power mode that does not record data, but will retain data already recorded for long periods. This mode is recognised by a single digit showing continuously in the display window. Once the "sleep" mode is reached, a control box is needed to re-activate the ANAREC and readout the data.

ANAREC

SPECIFICATION

SIZE:	140 mm x 120 x 110
WEIGHT:	0.7 Kg
DURATION:	Data capture for 37 days
DATA RETENTION:	Up to 80 days in sleep mode
SAMPLES:	Records hourly average wind speed
SIMPLE DISPLAY:	18 Values summarising wind speed against duration for the recording period
DETAILED DISPLAY:	Almost 900 values showing average windspeed hour by hour
18 SPEED RANGES:	0 to 10 metres/second in 1m/s steps, 10 to 20 m/s in 2 m/s steps, 20 to 30 m/s in 5 m/s steps, 30 m/s and above- all one range
FREQUENCY INPUT:	0.0375 per second per m/sec
OPERATING TEMP:	0-50 C battery excluded
POWER SUPPLY:	3 x 9 volt Batteries, type 216 rectangular
OTHER FEATURES:	Indicator showing contact closures from anemometer Present velocity readout (26 second average ± 1 m/s) Computer compatible parallel interface
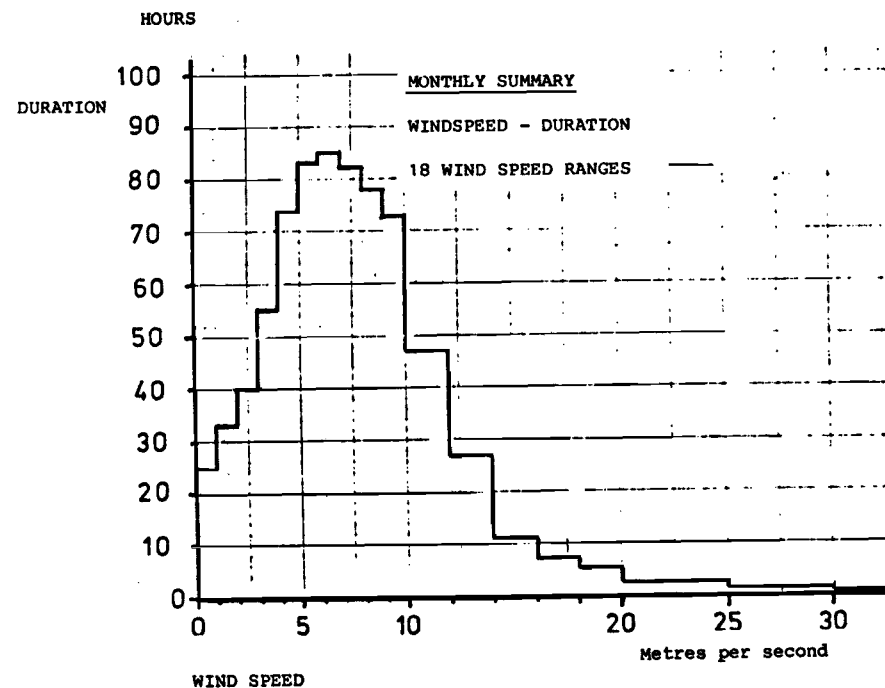
Price: ANAREC $450,   Connector & Cable $30,   Control Box $35, Anemometer $95

For further information, please contact Mr. Peter Rodeck,

ENVIRONDATA, P.O. BOX 395, WARWICK. Q. 4370.   (076) 61 4450

Environdata Australia Pty. Ltd. reserves the right to change specifications without notice.

Card p/2b2

Anemometer Euclide Pw autonomous system

Anemometer Euclide Pw is an instrument for windspeed data
surveying. Such data are required to determinate the type of
aeromotor to be installed on place.
Any aeromotor take its right position towind automatically.
Therefore data on wind direction are unnecessary. So only
windspeed data are required with particular attention to hourly
average as shown in Weibull theory.
The instrument has a very short energy consumption. therefore it
can operate without troubles in lonely areas powered byan hermetic
battery and a photovoltaic panel.
The optimal operating height of the probe is about 1o mt.
For that purpose a demountable inox steel pole equipped with
wind-bracing cables has been projected.
Before pole instalation it is required the construction of
foundation plinths (dimensions can vary in relation to ground
characteristics). The plinths are four: a central plinth where
fixing the hinged plate and three plinths placed at 12o degrees
where fixing wind-bracing cables.

The printing gives the following data:

```
ooo   ooo.ooo   km/h
oo1   o26.765   km/h
...   .......   ....
```

The first three numbers indicate the hourly progressive survey.
The second group of numbers indicate the average windspeed in
km/h, with three decimal numbers, of the specificated hour.
The supplied paper reel, lenght 4o mt height 57mm, lasts about 1o
months.

The analogic dial in front of the instrument gives instantaneous
windspeed in meter/second.

The power consumption of the instrument is o.3oo Ah, about 86.4
Watt/day.
Installed battery is 12V, 36 Ah.

M·A·N

rollo bv
Postbus 275
2501 CG Den Haag
Holland
Telefoon: 070/46 97 11
Telex: 31415

Wind Classifier
zur Bestimmung von Windgeschwindigkeitsverteilungen

Berechnungsbeispiel für AEROMAN 11/14 auf PELLWORM
(Deutsches Testfeld für kleine Windenergieanlagen)

Cut-out-Geschwindigkeit Vco	24,0 m/s
Rotorleistung	17,9 kW
Install. Generatorleistung	14,0 kW
Cut-in-Geschwindigkeit Vci	3,2 m/s
Nenn-Geschwindigkeit VN	10,1 m/s
Rotordrehzahl	88,0 U/min
Jahresenergieproduktion	55,1 MWh/a
– Vollastbereich	25,5 MWh/a
– Teillastbereich	29,6 MWh/a
Betriebsstunden, gesamt	7550 h/a
– Vollaststunden	1825 h/a
– Teillaststunden	5725 h/a
Stillstandszeit	1210 h/a
Nutzungsgrad der Anlage	44,9%

Technische Daten

Einsatztemperaturbereich	–20°C bis +70°C
Wartungsfreie Betriebszeit	> 2 Jahre

Windaufnehmer

Schalensternanemometer	130 mm ⌀
Maximale Windgeschwindigkeit	60 m/s
Ausgangssignal	Gleichstrom
Schalenstern, Material	ABS
Masse	0,65 kg
Meßwertkabel	15 m

Auswertegerät

Gehäuse	Aluminium, korrosionsgeschützt 160 x 160 x 90 mm
Schutzart	IP 65
Windklassen	3– 5 m/s
	5– 7 m/s
	7– 9 m/s
	9–12 m/s
	> 12 m/s
Ablesung	Stundenzähler, rücksetzbar
Anzeige der Windgeschwindigkeit (analog)	0–15 m/s
Meßzeittakt	1,4 s

Stromversorgung

Speisung wahlweise	Solarzellen o. Netzanschluß (220 V/50 Hz)
Akkumulator-Pufferung über elektronisch geregelte Ladekennlinie	

Elektronik (C-MOS)

Betriebsspannung	6 V Gleichstrom
Stromaufnahme	ca. 11 mA

Windgeschwindigkeitsverteilung
auf PELLWORM

Leistungsdiagramm des AEROMAN 11/14 auf PELLWORM

Leistungsverfügbarkeit
des AEROMAN 11/14 auf PELLWORM
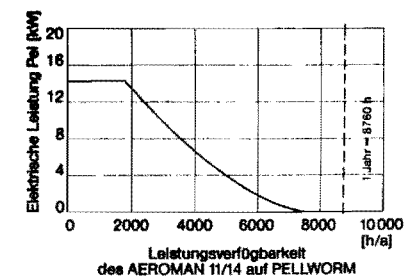
WINDLOGGER
Wind analysis has never been so simple or inexpensive!

Choosing a wind system depends on the wind available at your site. How much power will it produce? This is what determines whether the investment will be worthwhile. Power output estimation requires two things:-
● details of the wind turbine
● details about the wind at your site

Manufacturers provide the first, the Windlogger will produce the second.

What wind data do you need? The average wind speed is not enough. You need the wind speed distribution or what percentage of the time the wind is strong enough to provide full output from the wind turbine, what percentage at half output, etc.

The **Windlogger** is purpose built for this job. It processes the results as it collects them. The latest distribution is available at any time at the flick of a switch. No further processing of the wind data is normally required.

QUALITY

Windlogger is built up to standard, not down to a price.
Windlogger offers:-
● 30 bins
● 12 month battery life
● Range of 0-30 m/s
● Accuracy of 0.5 m/s
● Timekeeping to ± 2 min/month
● CMOS integrated circuitry for maximum reliability
● Operating temperature range of –20° to +60°C

Windlogger comes equipped with its own 3 cup anemometer, and 15m of signal cable.

Compact, reliable and easy to use **Windlogger** comes complete with a comprehensive guide to wind system selection. **Windlogger** enables you to make the right wind system decision first time. Windlogger is a lot cheaper than the wrong decision!

OPERATING PRINCIPLES

Every minute **Windlogger** records the windspeed in the memory appropriate to that particular speed band. Retrieving the data is simplicity itself. At the flick of a switch **Windlogger's** visual display cycles through the recorded data showing the speedbands and cumulative times logged for each band in hours and minutes, along with current windspeed and total elapsed logging time.

RELIABILITY

Low power requirements, and a wide range of operating temperatures combine with the 'no moving parts' electronics to guarantee **Windlogger's** tremendous reliability, even at sub-zero temperatures. Rigorous quality control means that **Windlogger** just keeps on running.

'EASY TO READ'

band	time
0→ 1m/s	49H29m
1→ 2m/s	89H26m
2→ 3m/s	121H39m
3→ 4m/s	168H 8m
4→ 5m/s	183H48m
5→ 6m/s	170H25m
6→ 7m/s	151H12m
7→ 8m/s	119H58m
8→ 9m/s	85H39m
9→10m/s	59H35m
10→11m/s	39H15m
11→12m/s	24H25m
12→13m/s	13H16m
13→14m/s	7H14m
14→15m/s	4H25m
15→16m/s	2H28m
16→17m/s	1H31m
17→18m/s	0H42m
18→19m/s	0H11m
19→20m/s	0H 1m
20→21m/s	0H 0m

windspeed (m/s)

*9 bins omitted as time logged = zero

>30m/s	0H 0m
WIND NOW	3m/s
ELAPSED	1292H51m
NEW WINDLOGGER	

Data is presented simply and clearly so constructing a wind velocity histogram is quickly and easily accomplished.
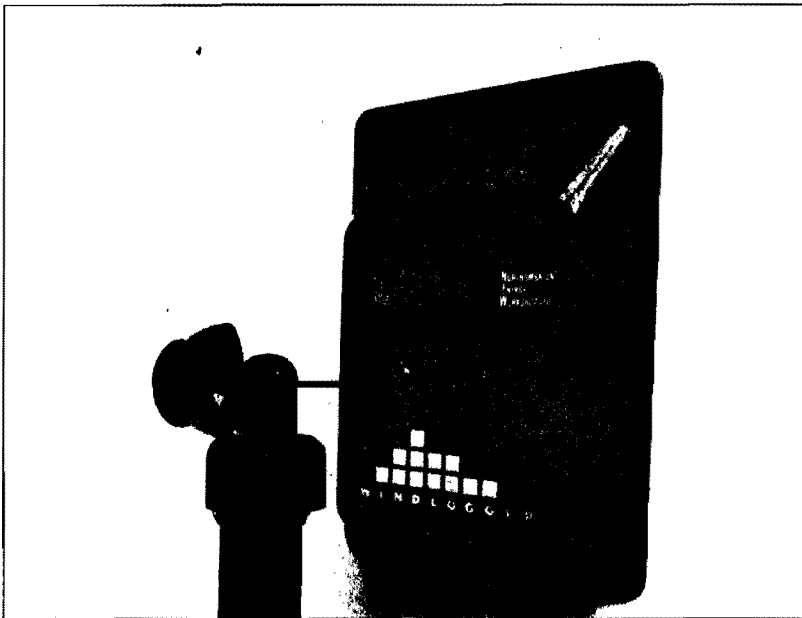
Windlogger has been developed by Northumbrian Energy Workshop as a compact, reliable and easy to use binning datalogger system for less than a wind run anemometer.

Choosing a wind system depends on the wind speed distribution at your site. Every minute, Windlogger records the windspeed in the memory appropriate to that particular wind speed band. At the flick of a switch Windlogger's visual display cycles through the recorded data showing the speedbands and cumulative times logged for each band in hours and minutes, along with current windspeed and total elapsed logging time.

Windlogger offers

- 30 Bins
- 12 month battery life
- Range of 0 - 30 m/s
- Accuracy of 0.5 m/s
- Time keeping to ± 2 min/month
- CMOS integrated circuitry for maximum reliability
- Operating temperature range of -20 to +60 C

Windlogger comes complete with its own 3 cup anemometer and 15m of signal cable.

Windlogger reliability

Low power requirements; a wide range of operating temperatures; CMOS integrated circuits and rigorous quality control combine to guarantee Windlogger's tremendous reliability.

WINDLOGGER SPECIFICATION

PHYSICAL

Windlogger	Dimensions 220mm (w) x 320mm (h) x 50mm (d)
	Weight 0.75kg unpacked
	Operating Temperature display off -20° to +60° C
	display on -10° to +60° C
Anemometer	3 cup, UV stabilized plastic
	Mounting horizontal M5 brass stud
	Supplied with 15m signal cable

ELECTRONICS   CMOS integrated circuits used throughout
Switch mode power supply

POWER REQUIREMENTS

Source	Lithium Tadiran TL 5137/T battery
	12 months operation over full temperature range
	Can be externally powered from 2.6 - 5.0 V DC
Consumption	less than 2mA at 5V DC

SAMPLING

Windspeed	every minute count integrated.
Range	0 to 60 m/s
Resolution	0.1 m/s
Accuracy	0.5 m/s

TIMEKEEPING

Accuracy	± 2 minutes per month

FUNCTIONS

Velocity Distribution	Windspeed distribution from 30 bins 1m/s wide based on 1 minute average readings
Resolution	1 minute
Maximum count	9999 hours
Current Windspeed	Displayed every five and a half minutes based on last one minute average
	Resolution 1m/s

DISPLAY CYCLE

Display	16 character alphanumeric LCD
	Display is changed every 10 seconds
	Steps through bins one at a time and then displays elapsed time and current wind speed.
Cycle time	5.5 minutes

Northumbrian Energy Workshop are leading specialists in the design and installation of renewable energy systems. Our reputation for innovation and technical excellence is maintained today by the incorporation of only the best technology into our systems.

Every effort has been made to ensure the accuracy of this data sheet at the time of going to press. However, because of a policy of continued development and improvement N.E.W. Ltd. reserves the right to alter specification without notice.
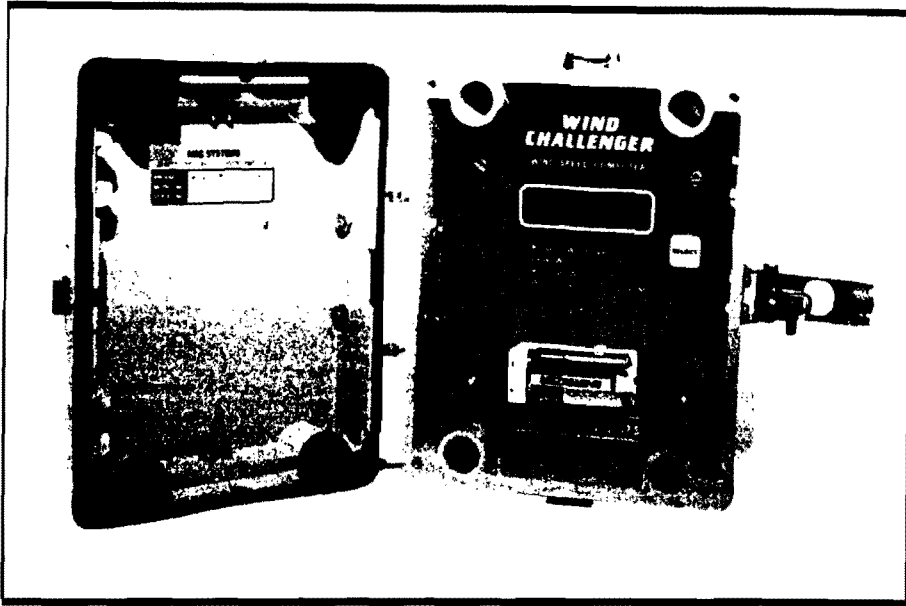
The Wind Challenger #7010

The unique Wind Challenger #7010 adds the power of a low power microchip to precision wind measurement. Now you can gather data for small wind turbine siting, monitor wind turbine performance, track wind farm operations, or conduct wide area studies for wind mapping... with all the precision and reliability of state-of-the-art computer technology.

NRG Systems

Church Hill Road, Charlotte, VT 05445 USA
(802) 453-4662
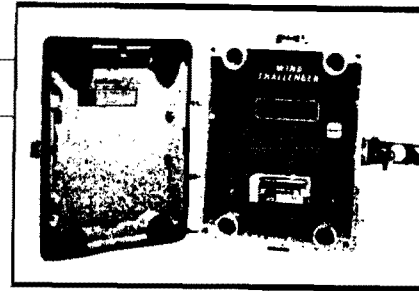
The 7010 is the newly updated version of NRG's pace-setting model 7000. Some of the refinements in the new 7010 include: Wind Power Density (watts/meter-squared) re-calculated with each new sample; Hour of Peak Wind Gust readings; user selectable cut-in windspeed; lull set point and units; duration of longest "energy lull," and more.

FEATURES:

- User selectable cut-in speeds (8), lull set point (8) and units (mph or m/s)
- Displays and computes 8 functions:
  - Present Windspeed—Updated every second
  - Peak Wind Gust—Up to 220 mph
  - Average Windspeed—True average calculated from wind run
  - Power Density (W/M²)—Actual wind energy measured (V cubed)
  - Elapsed Time—Hours since reset (0.0 to 9999 hrs.)
  - Hour of Peak Wind Gust—Time gust occurred
  - Cut-In Speed/Hours Above Cut-In—User selected cut-in speed
  - SP/Duration of Wind Energy Lull—Continuous hours below setpoint
- Very low power consumption; 6 month life with one 9v transistor battery (Alkaline)
- Rugged, weathertight fiberglass enclosure
- Stainless steel latches and hardware
- Ultra-wide temperature range (−40°F to 160°F)
- Large, easy to read LCD display
- Stable, precise quartz crystal time base
- Full 1-year limited warranty
- State-of-the-art computer technology
- Complete with 3-cup sensor, 60′ cable, stub mast, battery and instruction

SPECIFICATIONS:

Power: One 9v alkaline battery; over 6 months operation in moderate climates. Lithium batteries available for extreme low temperatures. Power drain less than 100 uA average. One year life.
Display: Ultra wide temperature range, 4-digit, .5″ LCD with function number and indicators for m/s, hours and mph. Data read out on four digits.
Enclosure: NEMA type 4, 4x & 13. Stainless steel latches, hardware; hasp for padlock. 6.5″ × 8″ × 5.5″.
Sensor: 3-cup Lexan anemometer head; AC signal output for frequency counting. Type #40.
Sensor Cable: 2 conductor, 22 gauge shielded
Timekeeping Accuracy: ±10 minutes/month
Sampling Rate: One sample per second
Wind Speed Range: 0–220 mph
Wind Speed Resolution: 1 mph
Wind Speed Accuracy: +1.0, −0 mph

OPTIONS AVAILABLE:

Lithium battery, mounting kits, extra sensor cable, custom functions on units.

Price: $450
For Export Add: 20%

NRG Systems

Church Hill Road
Charlotte, VT 05445 USA
(802) 453-4662

SPECIFICATIONS MAY CHANGE WITHOUT NOTICE

Parkway Energy Products

PARKWAY'S WIND SITE ANALYZER

A microprocessor-based wind recording system to tally
wind counts over user programmable time periods. Permits
optimal machine siting, wind energy, and economic analysis.
Also ideally suited to a community network of farmers,
chain stores, libraries, schools, churches, etc. Battery
or AC operation, complete with anemometers, adapter, cable
and instructions. Get the most out of your WECS.

HOURS
120
100
80
60
40
20
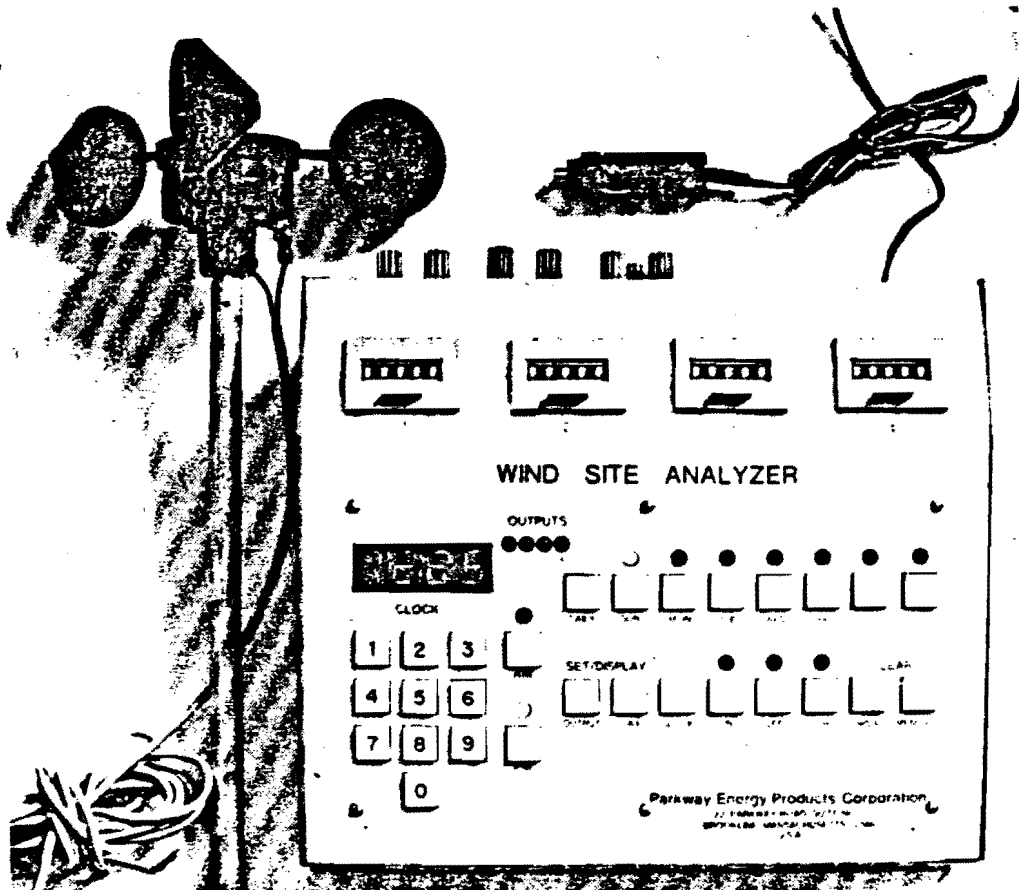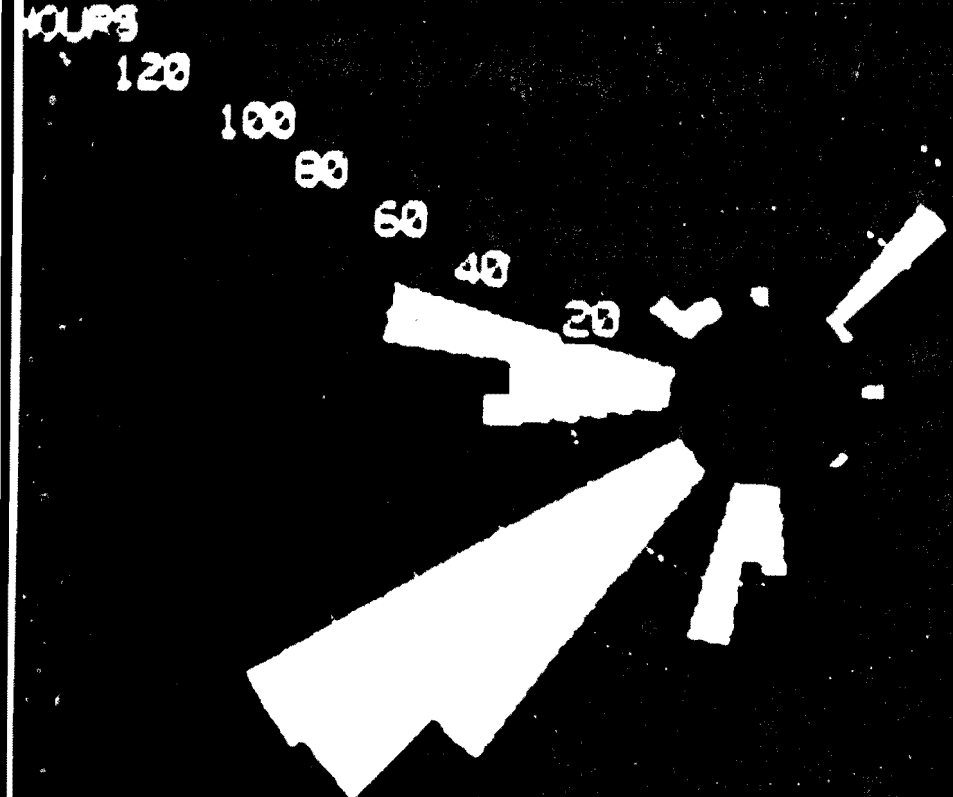
SOUTH

SECOND WIND AL·2000

WIND RESOURCE DATA LOGGERS

A NEW CLASS OF INSTRUMENTATION FOR WIND POWER SITE ANALYSIS

AL-2000 SPECIFICATIONS

AL-2000

PHYSICAL:
Size: 8" x 10" x 4"
Weight: 10 lbs. w/ 1 year battery
Case: 14 gauge steel NEMA-4 weathertight
Temperature: −40° to +160°F operating

GENERAL OPERATIONS:
Sampling and Display:
Wind Speed: every 2 seconds, count integrated
Range: 0–255.5 MPH
Resolution: .5 MPH
Accuracy: +.5, −0 MPH
Wind Direction: every 2 seconds, modulo-360° filtered in software where appropriate
Resolution: ~1° (internal)
Eight points of compass (displayed)
Accuracy: <2°

Time Keeping:
Accuracy: ±2 minutes per month
Auto leap-year correction
Daylight savings time correction user-invocable

Data Storage:
Permanent Storage: Industrial Temp. rated 2516/2716 EPROM
Maximum Storage: 13 months of data

Power Requirements:
Less than 2mA average at >6VDC, 500mA max. instantaneous

Inputs:
Wind Speed: Interfaces directly to any AC anemometer with .300<MPH/Hz<1.990
Wind Direction: Interfaces directly to potentiometer-type wind vanes.
All inputs Electrostatic Discharge protected.

FUNCTIONS:
Diurnal Trends:
One average wind speed & day-to-day standard deviation data pair per 2 hour period (24 data points per month)

Type	Range	Resolution	Accuracy
Average	31.5 MPH	1 MPH	± 1 MPH
Standard Deviation	15.5 MPH	.5 MPH	± .5 MPH

Wind Rose:
Eight points of compass, 4 wind speed ranges per heading. Hours under 6 MPH recorded separately (32 data points per month)
Ranges: 6–12, 12–18, 18–24, 24 and greater MPH
Resolution: 1 hour
Accuracy: ±.5 hour

Velocity Distributions:
4 distributions, 1 total and 3 sub-distributions corresponding to "slow," "moderate," and "fast" yaw rates. Angular rates based on modulo-360° filtered wind direction. 16 wind speed ranges per distribution. Hours under 6 MPH and over 38 MPH recorded separately (66 data points per month)
VELOCITY RANGES:
2 MPH intervals, from 6 to 38 MPH
Resolution: 1 hour
Accuracy: ±.5 hour

Peak Wind Speed:
Peak speed updated every 2 seconds. Peak speed and time of occurrence (day, hour and minute) recorded.
Range: 255.5 MPH
Resolution: .5 MPH
Accuracy: +.5 MPH, −0 MPH

Lull:
Moving average updated every minute: $N = 60$, $\tau = 1$ minute.
End of lull determined by moving average $V_{N,\tau}(t) < 6$ MPH. Maximum lull duration each month is recorded as well as day, hour, and minute when lull ended.
Range: 255 hours
Resolution: 1 hour
Accuracy: ±.5 hour

Hourly Averages ("S" Versions):
Average wind speed from 60 1-minute samples, written to EPROM on the hour.
Range: 63.50 MPH
Resolution: .25 MPH
Accuracy: ±.125 MPH

AL-2002
Same as AL-2000, except:
1. Two complete sets of data, one for each anemometer & wind vane pair.
2. Data storage on Industrial Temp. rated 2532 EPROM.

AL-2000S
Same as AL-2000, except:
1. Records 5 months of summarized data and 3264 hourly averages on

AL-2002S
Same as AL-2002, except:
1. Records 3 months of summarized data and 1520 hourly averages for each sensor pair.

Specifications subject to change without notice

SECONDWIND

HOW USABLE IS THE WIND AT YOUR SITE?

Economic installation of a Wind Energy Conversion System (WECS) requires a detailed understanding of the wind regime at a particular site. It is important to determine,

- How much wind energy is available at a site,
- How much of that energy can be captured by a particular wind turbine, and
- How much of that energy will be available when it is needed.

Second Wind can provide these answers with its AL-2000 series of stand-alone wind resource data logging systems. Every two seconds the AL-2000 samples wind speed and direction to provide instantaneous readings, hourly averages, and monthly WECS-oriented statistical summaries. Each element of the summaries has quantitative validity based on wind energy economics, engineering and common sense.
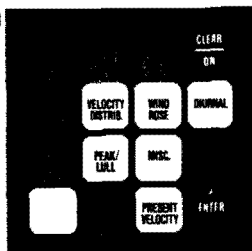
Velocity Distributions

Four velocity distributions are generated each month from two-second wind velocity samples. These indicate energy availability and turbulence at each wind speed. Only the combination of this information and WECS performance data can provide a true indication of how much energy can be generated by a particular WECS.
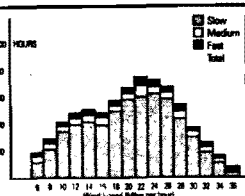
Wind Rose

The AL-2000 gives an enhanced form of the traditional eight-point wind rose. The total amount of time the wind blows from each direction is subdivided into each of four wind speed ranges. The wind rose can be especially useful in determining the effect of obstructions and topography on prevailing winds at the site.
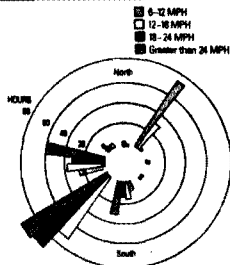
Hourly Averages

Some siting studies require a serial record of hourly average wind velocities. AL-2000 "S" series data loggers record time series wind speed data, in addition to the summarized monthly data. This information is particularly useful in correlation studies where historical data is typically in the form of hourly averages.

Diurnal Data

The diurnal data section of the monthly wind summary describes the average wind speed as it varies over an average day. The inter-day standard deviation of wind speed is also compiled for each time slot. This function facilitates a direct comparison of available wind energy to the demands of proposed applications. The data is especially useful in determining the value of the wind energy to both the user and the utility where interconnection and "buy-back" are being considered.
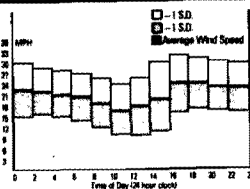
Peaks and Lulls
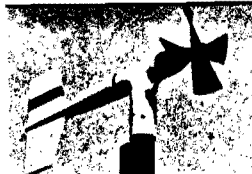
A major source of stress on a WECS is high wind speed. The AL-2000 records the maximum wind speed, and when it occurred, on a monthly basis. Data on periods of little or no wind are also important. The "lull" function records the duration of the longest "energy lull" and its time of occurence, every month. This function can establish reliability of the site for energy production, as well as help to size storage systems.
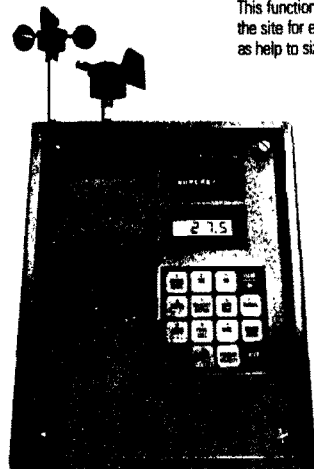
THE AL-2000 SYSTEM

AL-2000 series data loggers are cost-effective solutions to siting equipment needs. The AL-2000 is offered in a complete package that includes sensors, battery, and data storage medium, eliminating the search for matching components. Minimal training is required for effective installation and data retrieval. A typical AL-2000 system can be operated for up to a year without changing the internal battery pack or memory chip.

The stored data can be accessed easily in the field directly from the front panel of the instrument. NO ADDITIONAL EQUIPMENT IS NECESSARY. The same information can be processed on a computer by Second Wind or by users with appropriate hardware and software.

Normal Operation

Anyone can install and operate the AL-2000. No special training or calculations are necessary because all functions are preprogrammed. Simply tell the unit the time, date, and whether daylight savings compensation is desired. Close the data hatch on the front panel to prevent any interruption of the logging process and the unit is ready. The instrument will respond with English-language prompts to aid in examining stored data.

A Sequence of Read-outs From a Typical Request for Data Is Shown Below

    ✳MAY   83

User wishes to examine the WIND ROSE for the month of May, 1983.

    ✳NOREAST

User selects compass point of interest.

    06-12MPH

User selects the desired wind speed range.

    HOURS

The AL-2000 numeric display now shows the number of hours the wind blew from the northeast between 6 and 12 MPH during the month of May, 1983. The units of the numeric data (HOURS in this case) have been checked by pressing the UNITS key.

Computer Interface

All data is available at the front panel; however, the removable memory-chip containing the data is also well suited for other means of examination. Users who have access to data processing facilities or "personal" computers will find that the contents of the chip can be transferred easily via commercially available peripheral products. Second Wind can provide the AL-2000 data storage format, allowing further processing as desired. Applications software for the IBM PC is also offered.

A COMPLETE SERIES

AL-2002

The AL-2002 records the same data sets as the AL-2000 but contains an additional anemometer and wind vane pair. The AL-2002 is ideal for studying the effects of wind shear and determining the best height for a particular WECS. Because sensor pairs can be placed over a quarter mile apart, the AL-2002 delivers the performance of two data loggers in one package.

AL-2000S, AL-2002S

The AL-2000S records hourly average wind speeds in series, IN ADDITION to the data sets maintained by the AL-2000. The AL-2002S incorporates this feature for two sensor pairs. Each average and its hour-index is accessible from the front panel. There is even a "Fast Forward" and "Fast Reverse" feature to make scanning the data quick and easy. In memory-chip-to-computer applications, users appreciate the real-time stamping and serial number that is automatically stored with the data.

ADDITIONAL PRODUCTS AND SERVICES

Data Processing Services

Second Wind provides full data processing support for those who desire further analysis of stored data. A low cost, rapid-turnaround computer printout service is available. In addition, high quality, full color, computer-generated graphics (examples of which are shown in this brochure) can be supplied for professional presentations.

Optional Equipment and Accessories

AL-2000 series data logger packages are offered complete with the data logger, batteries (either alkaline or lithium), memory chip, anemometer(s) and wind vane(s). A wide variety of accessories are available including: mounting brackets, cable, coating of the circuit boards for humid climates, case variations, a rugged prop-vane anemometer, memory chip eraser... as well as all standard replacement parts.

Custom Engineering Services

Second Wind specializes in both wind power and electronic instrumentation. Services range from complete wind energy siting studies to custom electronics design and manufacturing. Second Wind has provided harsh-environment control devices and data loggers for the wind power industry and government agencies. Please call for further information.
Second Wind, Inc.
7 Davis Square
Somerville, MA 02144 USA
(617) 776-8520 Telex: 7105620112

CLASS IVa:

Manufacturer	number of pages	
Atmospheric Research & Technology	0	(see class II)
Ekopower	1	
Environdata Australia	1	
Natural Power	1	
Omnidata	2	
Secondwind	0	(see class III)
Summit Controls Corporation	1	

1. General description EKO 10 - line fielddatalogger-systems   version 86.2
1.1 Introduction

EKOPOWER designed several types of complete field datalogger-systems,
appropriate for a number of applications:

(remote) datalogging for e.g.:   FEATURES:
* meteorology   * ultra low power (batt. life 1/2 year)
* wind recording   * field proof (tropicalized)
* wind energy evaluation   * complete system
* environmental technology   * multi-functional
* process monitoring   * easy operation (no programming)
* ecology   * non-volatile solid-state memory
* agriculture   * multi channel (expandable)
* hydrology   * full stand-alone operation
* pollution monitoring   * data-processing with standard Personal
* product testing   Computer; possible a portable PC
* engineering   * software available
* energy management   * modular subsystems
                                            * record-check possibilities
                                            * low cost
                                            * remote control options

EKOPOWER has developed several standard types.
Each type is identified by a suffix:
EKO 10 A : winddatalogger for windspeed only. During a preset interval of time
           (usually 10 minutes or 1 hour) the average windspeed is recorded.
           Recording the max. gust is an option. The system meets the WMO/IEA 1)
           accuracy standards and is tropical resistant. Range: 0 - 50 m/s.

EKO 10 B : extended version of EKO 10 A with logging of the average wind-
           direction. The average winddirection is determined from an effective
           electrical angle of 3x 360 degrees. The system meets the WMO/IEA
           accuracy standards and is tropical resistant.
EKO 10 C : datalogger system for windturbine testing and evaluation, following
           the IEA-recommendations. Four channels are recorded:
           windspeed (0-25 m/s),wind direction, power-output and density of air.
EKO 10 D : extended version of EKO 10 C: up to 16 channels are possible.
EKO 10 E : universal automatic weather station: logging of wind speed, wind
           direction and a choice between temperature, humidity, pressure,
           precipitation and radiation. Meets WMO recommendations.

Combination of different models is possible (master/slave operation).
For each application a system can be designed according to customer
specifications; contact our application engineers to discuss your specific
datalogging problem.

For general information about EKOPOWER products please refer to:
* Guide to products, services and applications
* Introduction to measurements of wind speed and wind power

1) WMO: World Metebrological Organisation, IEA: International Energy Agency
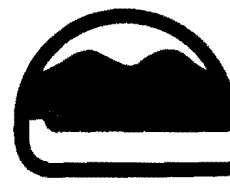
2

EASIDATA ENVIRONMENTAL RECORDING SYSTEM

Collection

- solar panel
- solar panel
- sensors
- EASIDATA
- TELEPHONE MODEM
- situated at the field site

Readout

- PORTABLE PRINTER
- PORTABLE COMPUTER
- carry to site
- or
- CENTRAL OFFICE COMPUTER
- TELEPHONE MODEM
- or
- one readout device serves many sites

EASIDATA

Environmental Recording System

EASIDATA is a computerised system for recording weather and environmental information. Sensors to measure rainfall, temperature and other key climatic factors are available as plug-in units. The complete system is solar powered, self contained and sealed for outdoor use.

ADAPTABLE RECORDING SYSTEM

An interchangeable part, the 'program' module, determines which climatic factors are to be recorded, the way in which they are recorded and how often. For example, an air temperature sensor can record daily average figures, along with minimum and maximum readings and specific values for morning (9 a.m.) and afternoon (3 p.m.). As well as standard weather station program modules, user defined systems can be supplied.

EASY TO USE

EASIDATA has been designed with ease of use in mind. Technical knowledge is not required. It is easy to install, it collects information unattended, and resulting data is easy to read.

COLLECTING THE INFORMATION

(a) On Site Collection

A portable computer or printer can receive the stored information at the EASIDATA recording site. Only one readout device is needed for any number of EASIDATA station.

(b) Office Collection

EASIDATA can be connected via a direct cable link, or through the telephone network, or radio link to a central computer to give direct access to stored information.

EASIDATA is a carefully designed and engineered product which was developed to provide accuracy, reliability and ease of use.
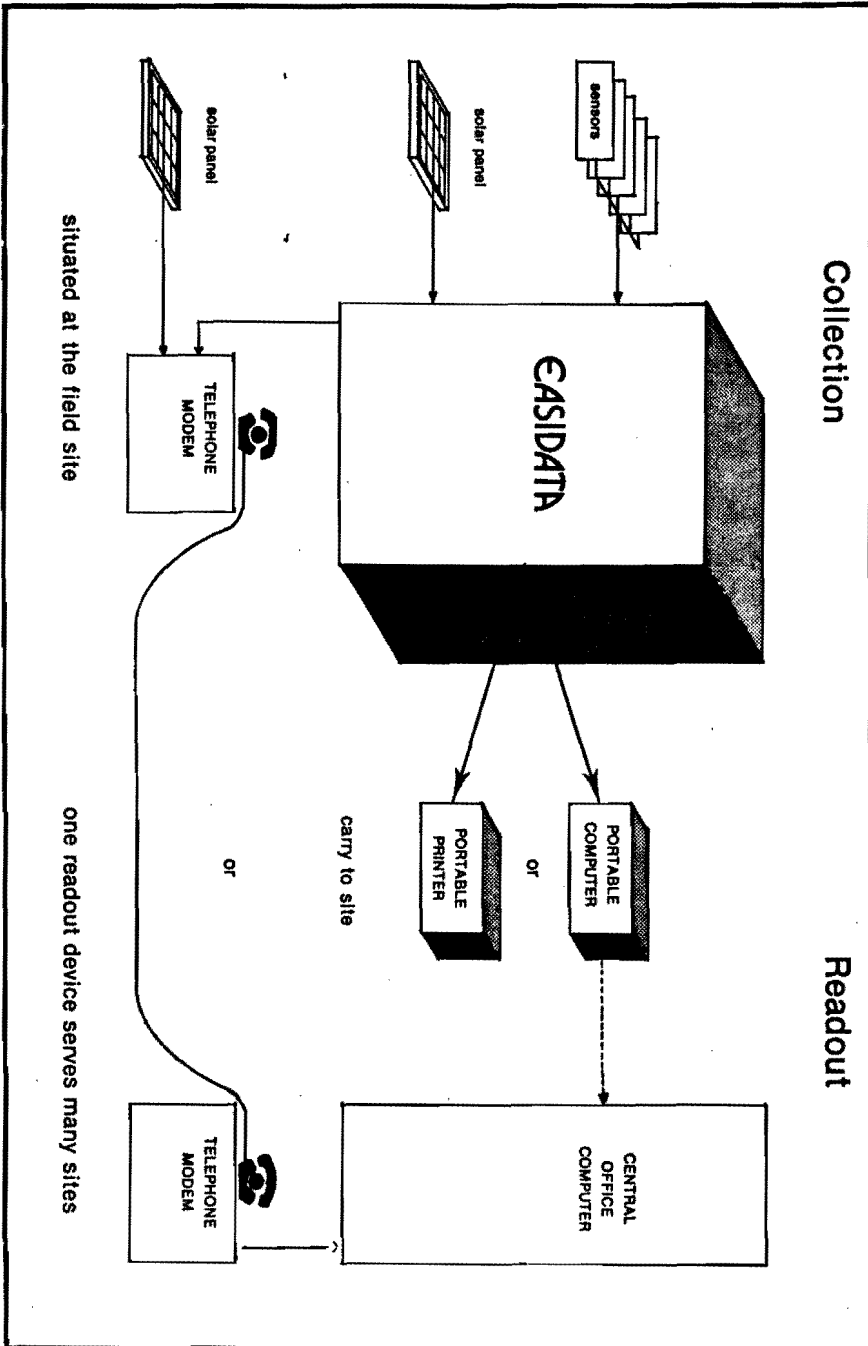
MODEL A30-501 COMPILATOR combines wind speed/direction data measurement capabilities with advanced data logging and data retrieval techniques providing measurement and processing to exactly match your requirements.

FEATURES: Up to seven anemometers.

User selectable sampling period one second to eight hours.

750 sample capacity for average wind speed and direction time series data, expandable to 30,000.

All data can be transferred directly from A30-501 to cassette tape in field. Cassette tape can be unloaded into Apple II and IBM PC computers without need of tape reader.

The information provided by the Compilator V can be used to:

* Determine suitability of a site for Wind Energy Conversion. Data collected is used to calculate available kinetic energy.

* Select the most suitable WECS for a particular site. Data collected is used to calculate energy production of specific wind turbines.

* Determine pollution and topographical effects, study environmental impacts, monitor wind velocities for safety considerations.

The reference anemometer and direction sensor are sampled once per second. This information can be averaged for up to eight hours and then used to update the various frequency distributions. Additionally the time history of the reference anemometer and direction sensor are recorded. A capacity for 750 speed and direction samples is standard, expandable to 30,000.

Anemometer and direction sensors provide input signals for multiple frequency distribution data sets compiled and logged by the Compilator V's processor.

A single anemometer and direction vane provide the reference data set consisting of 2 bivariate frequency distributions. These are comprised of 8 direction sectors with 32 speed bins each, and eight 3-hour time sectors of 32 speed bins as well.

In addition, the peak wind speed, time, date and direction are recorded, while the current speed and direction may be digitally displayed when desired.

Six additional anemometer inputs are available, each addressing a dedicated 32 bin frequency distribution data set. Sensor cable extensions to several thousand feet provide flexibility in siting and allow centralized data collection from distant anemometers.

Compilator V data may be read in several ways, allowing users to choose the method best suited to their needs. All data may be interrogated manually; displayed digitally on an LED front panel meter. This is especially helpful for visually monitoring instantaneous values, peak wind data and clock functions, and is useful in verifying sensor performance and data collection.

More importantly, all data may be retrieved automatically by utilizing either audio cassette tape or printer outputs, standardly provided on the Compilator V.

This enables direct compatibility with other computers and provides the means to quickly, accurately and inexpensively record all data contained in the instrument.

All data remains in the instrument after recording, allowing for years of continuous data collection.
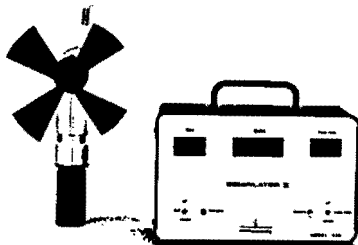
Cassette tapes are directly compatible with computers such as the IBM PC and allow the Compilator V data set to be manipulated to exactly meet the end user's requirements, whether it be energy computations, or compatibility with other equipment.

Custom programs are available for the Compilator V to meet your special requirements, contact the factory for assistance.

The Compilator V has been engineered to operate continuously under a wide range of temperatures from -40 to 70°C, and when installed in a weatherproof housing (Model A30-95) is suitable for stand alone monitoring under even the most adverse conditions.

All sensor inputs are protected from high voltage transients, internal rechargeable batteries ensure uninterrupted operation from power source loss (AC or DC), and power drain has been minimized to simplify remote operation from battery or photovoltaic supply.

Each instrument is furnished complete, with a 3 cup anemometer (Model A75-104), a direction vane (Model A75-301), 60 ft. of interconnecting cable, mounting hardware and complete instruction. Additional anemometers (A75-104), weatherproof housing (A30-95), and photovoltaic power supply (A90) are not included and may be purchased separately.

SPECIFICATIONS: A30-501

Operating Power: 105 to 127 VAC, 60 Hz; 6 to 15 VDC 20ma accumulate mode, 300ma display mode. Optional photovoltaic powered perpetual battery.

Input Devices: A75-301 optically encoded direction head, A75-104 cup anemometers. Other high performance sensors on special order.

Displays: 8 digit LED data display, 2 digit LED bin number display.

Controls: Power, Function Selector, Bin # control, Record switch.

Outputs: Audio Cassette, RS232C.

Accuracy: Time, ±15 min./month; Anemometer, see approp. spec.; Electronics, 1 EPUT±.01%; Direction, ±10°.

Resolution: 1 to 7mph bin width, user adjustable, eight direction sectors, 1 second sample rate, eight 3 hour time sectors.

Temperature Range: -40 to 70°C.

Environmental Protection: Lightning protection on all sensor lines.

Dimensions: 11"w x 9"h > 7 1/2"d.

Weight: 5 lbs.

Connectors: Sensor inputs, barrier strip to accept AWG #12 or smaller wire; three prong AC power line plug, 25 pin AMP connector, Serial I/O.

Special Requirements: External lightning protection recommended for sensor protection.

WHAT IS THE DATAPOD?

The DATAPOD Digital Recorder is a miniature, battery-operated data logger designed to replace strip chart recorders in many applications. Rather than continually recording a trace on paper as does a strip chart recorder, the DATAPOD processes sensor readings under program control of a microprocessor, and records values such as averages, event counts, or time of event in a solid state memory module.

WHAT KINDS OF SENSORS CAN BE USED WITH THE DATAPOD?

The DATAPOD logs data from weighing precipitation gauges, tipping bucket rain gauges, stream level sensors, solar radiation sensors, and temperature sensors. Different models of the DATAPOD record volts, millivolts, contact closures or logic pulses. Many types of industrial and environmental sensors can be used with the DATAPOD. If the particular application of interest is not listed in this brochure, consult an applications engineer at the factory.

HOW IS THE DATA STORED?

Data is stored by the DATAPOD in a non-volatile solid state memory called the DSM1000 Data Storage Module (DSM). The DSM plugs into a socket on the inside of the DATAPOD case. When the DSM is full, it is exchanged with a fresh one. It has a capacity of either 1023 or 2047 readings depending on the data resolution of the particular model of DATAPOD used. An LED on the DATAPOD panel flashes when data is being stored in the DSM. The maximum period of unattended operation depends on the type of data being stored and the recording interval set on the DATAPOD, but typical service intervals range from one to several months.

HOW ARE THE SENSORS CONNECTED TO THE DATAPOD?

There are either one or two rubber booted sealed connectors on the side of the DATAPOD Recorder case which accept a mating connector from the sensor. A mating connector cable should be purchased with the DATAPOD Recorder. The sensors that Omnidata supplies have the mating connector already installed.

HOW IS THE STORED DATA TRANSFERRED TO A COMPUTER?

When the DATAPOD is serviced in the field, the full Data Storage Module is removed and a fresh one is installed in its place. Back at the data processing facility, the full DSM plugs into the panel of the Omnidata 217 Reader which is connected to the computer system via an industry standard RS-232-C interface. Data can be read from the DSM either by remote control from the computer or terminal, or by pressing the data transmit button on the reader panel. Information in the DSM will be automatically formatted and transmitted to the computer and terminal. Exposure of the DSM to the UV erasing lamp for one hour erases the DSM and readies it for reuse in the field.

CAN DATA BE REVIEWED IN THE FIELD?

Pressing a button on the side of the DATAPOD case causes stored data to be recalled to the display. The short display mode shows how much space is left in the DSM and whether or not any errors have been made in storing the data. A long display mode retrieves data from the DSM and shows it on the display. Although it would be time consuming, the entire contents of the Data Storage Module can be retrieved using this method.

HOW RUGGED IS THE DATAPOD?

The DATAPOD circuitry is housed in a 2.3" x 3.3" x 6.3" polycarbonate case with an O-ring gasket, sealed connectors, and sealed switches. It needs no protection from the environment except for a sun shade during the warmer months. It operates in temperatures down to −35 degrees C and in humid environments to 100 percent relative humidity.
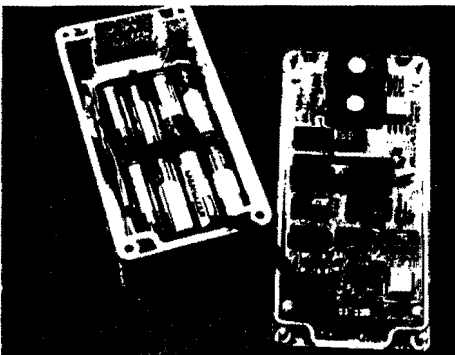
WHAT IS THE BATTERY LIFE?

The DATAPOD Digital Recorder typically operates for 9 months on one set of batteries. Some models of the DATAPOD are programmed to do more processing, and as a result have a shorter battery life, perhaps as low as 4 to 6 months. The DATAPOD Recorder uses a set of 8 alkaline "AA" cells for power. A "lo bat" indicator on the display indicates when remaining battery life is less than 2 to 3 months.

HOW DO I DECIDE WHICH DATAPOD MODEL IS RIGHT FOR MY APPLICATION?

Omnidata manufactures several models of DATAPOD Recorders for a variety of applications. All models record data from either one or two input channels. The following pages describe the various models and programs used in these models for many applications. If you still have questions on which unit to use after having studied this information, our applications engineers will be happy to discuss your data recording problem with you. Omnidata manufactures other lines of recording equipment to handle multichannel applications.
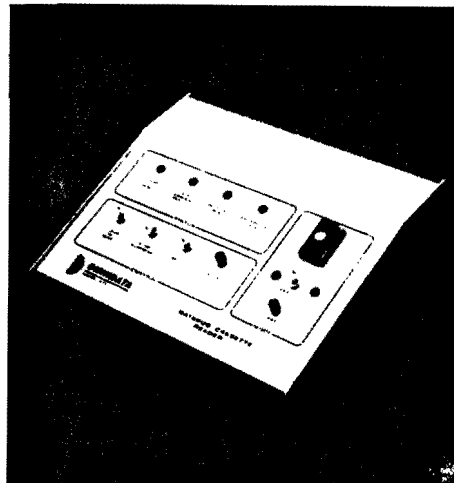
217 DATAPOD/CASSETTE READER

Omnidata International, Inc. manufactures a line of data loggers that record data on either a Data Storage Module or on audio cassette tape. The model 217 Reader removes data from these media and transmits it to a terminal or computer or both. Two 25 pin "D" connectors on the rear panel connect the reader to the computer and terminal.

RETRIEVING DATA FROM A DATA STORAGE MODULE
A full Data Storage Module from a DATAPOD is inserted into the 24 pin socket on the 217 Reader panel. Upon command from the reader control panel or the terminal, the reader transmits data from the Data Storage Module to the serial interface. The reader can be set to transmit data with or without day and time information.

RETRIEVING DATA FROM AN AUDIO CASSETTE RECORDER
The Model 217 Reader retrieves data from cassette through the cassette inputs on the rear of the case. A control signal from the "REMOTE" jack turns the cassette motor on and off. The data from the cassette is transmitted to the reader over a cable which plugs into the "MONITOR" jack. The 217 Reader activates the cassette, reads a block of data into memory, then shuts down the cassette motor, processes the data, and transmits it to the computer and/or terminal

CONTROLS
The panel controls on the 217 Reader simplify interfacing to computer and terminal equipment. A MODE switch selects data retrieval for either audio cassette tape or a Data Storage Module. The TFS1 button, when in the

MODULE mode, initiates a check which shows whether the DSM has been completely erased and re-readied for field use. In the CASSETTE mode, the TEST function allows adjustment of the volume level of the playback recorder for optimum signal output. Red and green LED's on either side of the mode switch indicate status resulting from the test. A TRANSMIT RAW DATA button initiates data retrieval without any commands from a terminal. CLEAR TO SEND and ECHO SUPPRESS switches aid in setting up the RS-232-C interface with the computer and terminal. The upper row of LED's on the 217 Reader panel indicate status of CTS, DTR, Transmit, and Receive lines.

The terminal and computer or modem communicates with the 217 Reader through serial ports located on the rear panel of the reader. The signal levels and pin assignments of these ports conform to the EIA RS-232-C specifications which are used by most computer terminals and most modems in use today. Some terminals often used with the 217 Reader are the Texas Instruments Silent 700 Series, Digital Equipment Dec-writers, Teletype Model 43, and many others. Current loop devices such as the old ASR 33 Teletype will not interface with the model 217 Reader.

The Model 217 Reader accepts commands over the RS-232-C port from the computer or terminal. The main set of commands tell the reader to transmit data continuously, to transmit just one line, or to stop data transmissions. Protocol characters for transmission and system initialization are user definable.

Specifications

CASSETTE: Audio cassette recorded in ASCII (8th bit parity)

DATA STORAGE MODULE: 2048 byte EPROM with polarized carrier.

BAUD RATES: Switch selectable at 300, 1200, 2400, 4800, & 9600.

INTERFACE: Two 25 pin subminiature "D" connectors, one for the computer or modem, and the other for the terminal, both conforming to the EIA RS-232-C specification.

DATA RETRIEVAL CONNECTORS: For the audio cassette, one 3.5 mm standard audio jack for the mic cable, and one 2.5 mm standard audio jack for cassette recorder remote control. One 24 pin socket on the panel for the Data Storage Module.

POWER: 110 volts AC, 50 or 60 hz, 5 watts

The 217 Reader includes the model SC254 RS-232-C accessory cable

DP214—TWO CHANNEL
WIND RECORDER

Includes: WSD321 Wind Speed & Direction Package w/Zapnot Lightning Protection w/50 foot cable

DESIGNED FOR:

1. Wind speed and direction
2. Anemometer and wind vane
3. Maximum wind speed and its direction
4. True vector average of direction
5. 359 to 0 degree transistion
6. Lightning protection system

RECOMMENDED ACCESSORIES

2 ea. DSM1000 Data Storage Module
1 ea. UVS11E Data Storage Module Eraser
1 ea. 217D Datapod Reader w/SC254 RS232 Cable
1 ea. S17 Small Instrument Shelter (Optional)

DESCRIPTION

The Datapod Model DP214 is a rugged electronic Data-logger with reliable solid state Data Storage Module (DSM1000). The Datapod is powered by 8 self-contained penlight cells (batteries not included). Data Storage Modules are interchangeable and computer compatible when read with Omnidata Model 217D Reader. The 4½ digit LCD display is for user prompts and data display. LED Indicator flashes when data is stored in DSM1000. Low Battery Indicator. Self-test functions. Totally sealed case. No moving parts. Easy to read even in bright sunlight. Crystal controlled clock.

EXTRA FEATURES

1. Control Button Functions:
   A. Review previously stored data
   B. Check number of Data Points Recorded
   C. Display number of recording errors (if any)
   D. Display current data
2. Programmable start time delay to sync data recording to real time
3. Vector averaging of wind direction
4. 359 to 0 degree transition detection
5. 0 to 100 mph wind speed range

SENSOR CONNECTION DIAGRAM
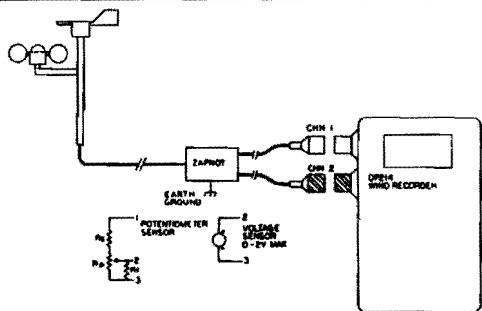
USER SETABLE RECORDING INTERVALS

Recording Interval	Scan Interval	Type Reading	Service Interval	Service Interval w/Max Min
1 minute	1 minute	inst	17 hours	8.5 hours
5 minutes	1 minute	ave	3.5 days	1 day
10 minutes	1 minute	ave	7 days	3.5 days
30 minutes	1 minute	ave	21 days	10.5 days
1 hour	5 minutes	ave	42 days	21 days
2 hours	5 minutes	ave	85 days	42 days
4 hours	5 minutes	ave	170 days	85 days
24 hours	10 minutes	ave	battery life	battery life

ELECTRICAL SPECIFICATIONS

GENERAL:	
Function:	Record average wind speed and direction; Max. wind speed with its direction.
Number of Channels:	Two—Chn. 1 = Wind Speed; Chn. 2 = Wind Direction.
Operating Temperature Range:	−35°C to +60°C, 100% RH
Clock Accuracy:	±3 minutes per month.
INPUT:	
Sensor Input:	WSD321 Wind speed and direction package with Zapnot lightning protection.
Sensor Resistance:	Maximum—100K ohms; Minimum—5K ohms (Wind direction only)
Input Voltage:	0 to 2 volts DC.
DATA RECORDING:	
Data Storage:	Non-volatile, UV erasable, no back-up battery needed.
Recording (Burn) Time:	2 sec. typ.
Data Storage Capacity:	1023 recordings per channel; 511 when recording maximum wind speed and direction.
Scan Interval:	1, 5, or 10 minutes.
Recording Interval:	User selectable.
Recording Resolution:	Speed to nearest 0.1 mph; Direction to nearest 6 degrees.
POWER SUPPLY:	
Power Supply:	8 "AA" Alkaline penlight batteries.
Battery Life:	6 months typ. (function of scan interval).

MECHANICAL SPECIFICATIONS

Case Material: Sealed polycarbonate, O-Ring gasketed case
Connector: Rubber sealed, 3 pin
Control Button: spst, sealed
Weight: 1.2 lb./0.54 kg.
Dimensions: 2.3" x 3.3" x 6.3"/5.8 x 8.4 x 16.0 cm

SUMMIT CONTROLS CORPORATION

MODEL WGC-110 REMOTE DATA LOGGER SYSTEM
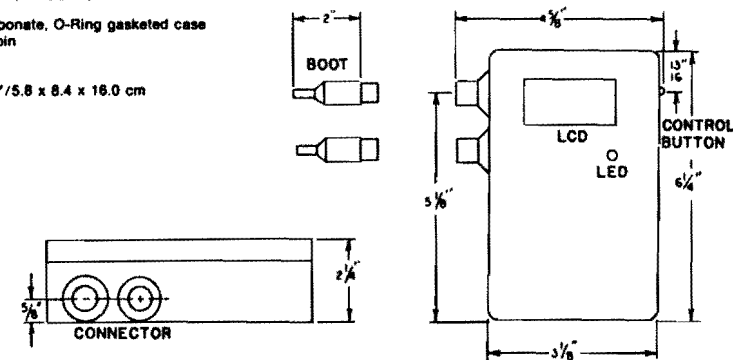
COMPLETE WIND DATA COLLECTION

The WGC-110 Remote Data Logger System is a battery-powered data acquisition system specifically designed for collecting and recording wind data. The unit is an essential site analysis tool for those who must make reliable economic projections involving wind energy conversion. The WGC-110 provides a complete data collection package, including sensors, data storage equipment, and batteries.

Data is collected and permanently stored in an EPROM memory within the unit. This data can be retrieved by removing the EPROM and having its contents read by a computer with the appropriate capabilities. Data printout and report generation services are available through Summit Controls or associated consulting firms.

The unit contains a low-power microcomputer, mounted in a weather-tight enclosure, and operates from standard commercial batteries. Wind speed and direction are sensed via a pair of precise, optical sensors. These two sensors are mounted and prewired on a bracket for convenient installation. An attached 55' cable with connector is included with the sensor pair. The system is shipped complete and operational with cables, connectors, and batteries fully assembled. The Summit Controls standard one-year warranty applies to this product.

FEATURES:

o Complete data acquisition system

o Permanent EPROM data storage

o Records average wind speed and wind direction at selectable intervals

o Precise, digital, optical sensors

o Rugged, weather-tight enclosure

o 16-segment direction data

o Convenient, ready to install

o Includes lightning protection
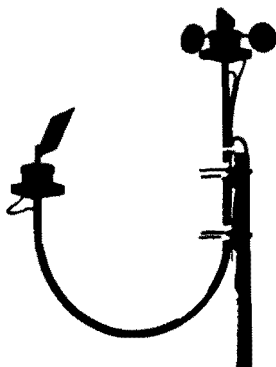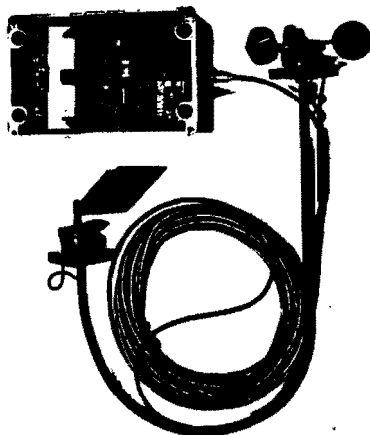
MODEL WGC-110 (all dimensions in inches)

ENCLOSURE

front view   side view

SENSOR ASSEMBLY

1/2" O.D. Aluminum Pipe
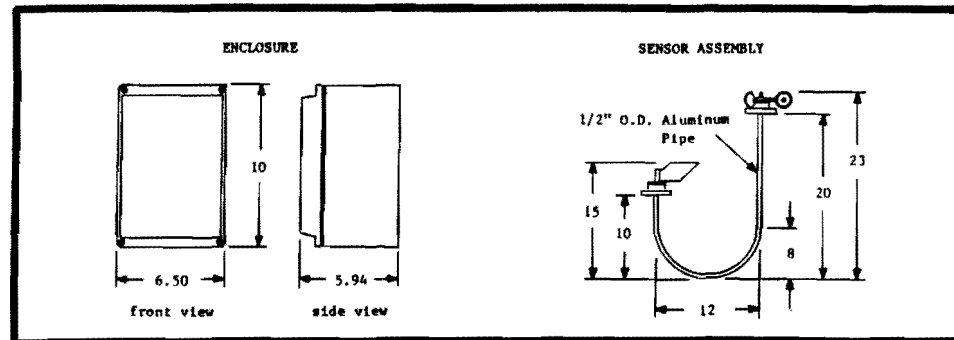
SPECIFICATIONS:

Power Requirements: (1 month operation)
four "D" cell alkaline batteries
three 9-volt alkaline batteries
complete set of batteries included with system

Sensors/Transducers:
digital, optical anemometer with 0.1 MPH resolution, from 0 to 100 MPH
digital, optical direction sensor with 16-segment resolution
both sensors included with system

Data Storage:
data (wind speed and direction) stored on CMOS EPROM - 4096 bytes (2732)
switch selectable recording period - 15, 30, or 60 minutes
42-day data storage at 30 minute recording period
data storage EPROM included with system

Operator Controls/Indicators:
pushbuttons: "anemometer test"
              "direction test"
              "battery test"
indicators: "sensors good"
              "5v batteries good"
              "25v batteries good"

Operating Temperature: -20 to 160 degrees F.

Terminations:
6-pin bayonet connector ¾" diameter
connector and plug with 55' of cable prewired and included with system

Housing: weather-tight, fiber glass enclosure

Weight: 12 lbs.

ORDERING INFORMATION:

Model WGC-110 Remote Data Logger System
(includes WGC-331 weather-tight data logger, WGC-240 anemometer/direction sensor pair preassembled on bracket with 55' of cable and connector, WGC-522 battery pack with batteries, and WGC-531 EPROM)

accessories:

Model WGC-531 EPROM Memory Module

Model WGC-522 Battery Pack
(does not include batteries)

Model WGC-323 Wind Speed and Direction Indicator
(used with WGC-240/241 sensor pair)

SUMMIT CONTROLS CORPORATION
1215 HIGH ST., SUITE 103
AUBURN, CALIFORNIA 95603
PHONE (916) 823-9329

CLASS IVb:

Manufacturers	number of pages
Bottemanne	1
Campbell Scientific	1
Data Electronics	2
Dulas Engineering	1
Ekopower	1
Grant	2
NES	1

SPECIFICATIONS DP 100   Data Processor

Housing	Water proof cabinet with Radiation/rain shield Euroboard mounting rack LCD and Hex-keyboard Cabel connectors Cabinet heating
Processor	8 bit microprocessor Real-time clock 4 Kb EPROM 4 Kb RAM RS 232C
Data storage	16 and 32 Kb static RAM Data storage in engineering units with 16 bit precision
Input channels	Up to 30 analog and digital channels
Digital input	Up to 6 channels per board 5 digit counter
Analog input	Up to 6 channels per board 8 and 12 bit ADC 20 mV to 5 V range
Pt-100 input	Up to 6 channels per board 0.05 °C resolution
Control and Retrieval	Input of parameters and Retrieval of records with Epson HX 20 portable computer through RS 232C, ASCII Baud rate 4800 max. Storage on microcassette Optional connection to any RS 232 compatible computer
Operating temperature	0 to +60 °C, without heating - 30 to +60 °C, with heating
Protection	Transient suppression using fast switching diodes
Power supply	Rechargeable lead acid batteries + 6 and - 6 VDC
Recharging circuitry	42, 110 or 220 VAC (field power) 12 VDC (solar panel)

21X MICROLOGGER

A Rugged, Powerful Little Datalogger

The 21X is a textbook sized, D cell powered precision datalogger. The term "MICROLOGGER" is descriptive of this MICRO-computer based dataLOGGER's MICRO-size, MICRO-power and sub-MICRO-volt sensitivity. It is the combination of a micro-computer, clock, multimeter, calibrator, scanner, frequency counter, controller, and signal generator all in one small box. Small size, low power and the ability to operate in environmental extremes were primary design objectives for portable, remote operation.

SIGNIFICANT FEATURES

PERFORMANCE VERSUS COST: Measurement and processing throughput in excess of 100 channels per second and sensitivity of ⅓ of a microvolt at 25 channels per second at a remarkably low price.

PERFORMANCE VERSUS SIZE: Sixteen analog and four pulse counting channels plus all the features described here packaged smaller and lighter (including batteries) than the CRC Handbook of Chemistry and Physics.

PERFORMANCE VERSUS POWER CONSUMPTION: Scanning and processing all 16 channels at 1 minute intervals, the 8 alkaline D cells last about 6 months. The rechargeable batteries in the 21XL provide 2 months' operation per charge under the same conditions.

SENSITIVITY AND MEASUREMENT SPEED: Fourteen bit precision on 5 software selectable ranges. 0.33 microvolt resolution at 37 milliseconds per channel with 100 nanovolt RMS input noise. At 2.5ms per channel the input noise is 1.2 microvolt RMS.

SENSOR COMPATIBILITY WITHOUT EXTERNAL SIGNAL CONDITIONING: Linearized thermocouple measurements at 7.3 milliseconds per channel resolve to within 0.05 deg. C. Bridge excitation voltage selectable within a ± 5 V range at .67 mV resolution. Resistance bridge measurements such as RTDs, load cells, pressure transducers, foil strain gages and thermistors optimize accuracy using AC excitation and ratiometric techniques. AC excitation also minimizes polarization errors in soil moisture, salinity, conductivity, and RH sensors. Four pulse counting channels accommodate magnetic pulse flow meters, photochopped or switch closure devices and incremental shaft encoders directly.

EXPANDABILITY: Analog inputs are expandable in 32 channel increments to a maximum of 192 channels using the Model AM32 Relay Scanner.

REAL-TIME DATA PROCESSING: User programmed processing includes linearization, algebraic and transcendental functions, engineering unit scaling, averaging, maximum/minimum, totalizing, standard deviation, wind vector integration with direction sigma, histograms, and more

REMOTE PROGRAMMING: Programs, parameters and direct commands can be entered directly from the keyboard or via the serial communications port from a remote computer or terminal.

FLEXIBLE DATA STORAGE AND TRANSFER: Data is stored in memory for transfer to the display, cassette, printer, modem, or directly to a computer. Expansion of 21X memory allows storage of up to 19,200 data values. The cassette recorder stores up to 180,000 values on one side of a C60 cassette at a maximum rate of 100 values per second

ANALOG AND DIGITAL CONTROL OUTPUTS: Two continuous analog outputs with 14 bit resolution are available for strip chart recorders or proportional control. Six digital outputs can be set based on time or processed input levels.

PROTECTED INPUTS AND OUTPUTS: All panel connections are protected from electrical transients using spark gaps or transzorbs.

OPERATION IN HARSH ENVIRONMENTS: - 25 to + 50 deg C, 0 to 90% relative humidity. The 21X packaging provides protection from excessive humidity and contaminants. On special order, 21X's will be tested and guaranteed to operate over a − 40 to + 60 deg. C temperature range

STANDARD CONFIGURATION

The standard 21X Micrologger includes 16 single ended analog inputs (any pair configurable as a differential input), 4 pulse counting inputs, 4 switched excitation outputs, 2 continuous analog outputs and 6 digital control outputs.

21X processing includes 23 instructions for measurements and control output, 39 instructions for data processing, and 9 instructions for program control.

Data storage includes 28 locations for input and user-processed data, 64 locations for intermediate values, and 896 final storage locations. Data storage can be re-allocated by the user. Each input location and each intermediate location uses 4 bytes of RAM and each final storage location uses 2 bytes of RAM. All expansion RAM is allocated for data storage.

A 9 pin D type connector on the front panel is used for serial data communication to cassette tape, memory module, modem or printer. It is also used for system programming via remote terminal or computer.

EXPANSION

Analog inputs can be added in 32 channel increments using the Model AM32 Relay Scanner. Up to 6 AM32s can be added for an additional 192 analog channels. Memory sockets are available on the 21X CPU board allowing the addition of 44K bytes of memory for a total of 64K bytes. An expanded system with 24K bytes of ROM and 40K bytes of RAM can store 19,200 values in the final storage area

21X Micrologger with the Model AM32 Relay Scanner for channel expansion.

SPECIFICATIONS

The following electrical specifications are valid for an ambient temperature range of − 25 deg. C to − 50 deg. C unless otherwise specified.

ANALOG INPUTS

NUMBER OF CHANNELS: 8 differential or up to 16 single ended using one differential channel for each two single ended channels.

CHANNEL EXPANDABILITY: The Model AM32 Relay Scanner multiplexes 32 differential channels through a single 21X differential channel. Up to 6 AM32 scanners can be added to a 21X for 192 additional analog channels.

VOLTAGE MEASUREMENT TYPES: Single-ended or differential. A thermistor at the input terminals provides reference junction compensation for thermocouple measurements.

ACCURACY OF VOLTAGE MEASUREMENTS AND ANALOG OUTPUT VOLTAGES: 0.1% of FSR, 0.05% of FSR (0 to 40 deg. C).

RANGE AND RESOLUTION: Ranges are software selectable for any channel. Resolution for single ended measurements is twice the value shown.

Full Scale Range	Resolution
± 5 volts	333. microvolts
± 0.5 volts	33.3 microvolts
± 50 millivolts	3.33 microvolts
± 15 millivolts	1. microvolt
± 5 millivolts	0.33 microvolt

INPUT SAMPLE RATES: The fast A/D conversion uses a 250us signal integration time and the slow conversion uses a 16.666ms signal integration time (one power line cycle period). Differential measurements include a second sampling with reversed input polarity to reduce thermal offset and common mode errors. The following intervals do not include the self-calibration measurement which occurs once per instruction. Input sample rates should not be confused with system data throughput rates.

Fast single-ended voltage:
2.4 milliseconds/channel
Fast differential voltage:
3.7 milliseconds/channel
Slow single-ended voltage:
18.8 milliseconds/channel
Slow differential voltage:
37.0 milliseconds/channel
Fast differential thermocouple:
7.3 milliseconds/channel

INPUT NOISE VOLTAGE:
Fast differential — 0.83 microvolts RMS
Slow differential — 0.1 microvolts RMS

COMMON MODE RANGE: ± 5 volts.

COMMON MODE REJECTION: >140 dB (DC to 100 Hz).

NORMAL MODE REJECTION: 70 dB (60 Hz with slow differential measurement).

INPUT CURRENT: 2 nanoamps max.

INPUT RESISTANCE: 200 gigohms

ANALOG OUTPUTS

NUMBER OF ANALOG OUTPUTS: 4 switched, 2 continuous.

DESCRIPTION: Switched and continuous. A switched output is active only during a measurement and is switched off (high impedance) immediately following the measurement. Only one switched output can be active at any one time. The 2 continuous outputs hold a preset voltage until updated by an analog output command.

RANGE: ± 5 volts.

RESOLUTION: 0.67 millivolts

ACCURACY: Same as voltage input.

OUTPUT CURRENT: 20 mA at ± 5 volts. 50 mA at − 2.5 volts.

RESISTANCE AND CONDUCTIVITY MEASUREMENTS

ACCURACY: 0.035% (0.02% 0 to 40 deg C) of full scale bridge output provided the matching bridge resistors are not the limiting factor. The excitation voltage should be programmed to match the bridge output with a full scale input voltage range.

MEASUREMENT TYPES: 6 wire full bridge, 4 wire full bridge, 4 wire, 3 wire and 2 wire half bridge. High accuracy, low impedance bridge measurements are ratiometric with dual polarity measurements of excitation and output to eliminate thermal emfs. AC resistance and conductivity measurements use a 750us excitation pulse with the signal integration occurring over the last 250us. An equal duration pulse of opposite polarity is applied for ionic de-polarization.

PULSE COUNTERS

NUMBER OF PULSE COUNTER CHANNELS: 4 eight bit or 2 sixteen bit, software selectable.

MAXIMUM COUNT RATE: 2550 Hz, eight bit counters; 250 kHz, sixteen bit counters. Pulse counter channels are scanned at a maximum rate of 10 Hz.

MODES: Programmable modes are switch closure, high frequency pulse and low level AC.

SWITCH CLOSURE MODE
MINIMUM SWITCH CLOSED TIME:
3 milliseconds.
MINIMUM SWITCH OPEN TIME:
4 milliseconds.
MAXIMUM BOUNCE TIME:
1 millisecond open without being counted.

HIGH FREQUENCY PULSE MODE
MINIMUM PULSE WIDTH:
2 microseconds.
MAXIMUM INPUT FREQUENCY:
250 kilohertz.
VOLTAGE THRESHOLDS:
The count is incremented when the input voltage changes from below 1.5 volts to above 3.5 volts.
MAXIMUM INPUT VOLTAGE:
± 20 volts.

LOW LEVEL AC MODE
This mode is used for counting frequency of AC signals from magnetic pulse flow transducers or other low voltage, sine wave outputs.

MINIMUM AC INPUT VOLTAGE:
6 millivolts RMS
INPUT HYSTERESIS:
11 millivolts.
MAXIMUM AC INPUT VOLTAGE:
20 volts RMS.
FREQUENCY RANGE:

AC Input Voltage (RMS)	Range
6 millivolts	1 Hz to 100 Hz
10 millivolts	0.5 Hz to 1000 Hz
20 millivolts to 20 volts	0.3 Hz to 2000 Hz

(consult factory if higher frequencies are desired)

DIGITAL CONTROL OUTPUTS

The 21X includes 6 digital control outputs that can be set or reset on command.

OUTPUT VOLTAGES
(no load): High — 5 volts ± .1 volt.
Low — <0.1 volt.

OUTPUT RESISTANCE:
400 ohms

TRANSIENT PROTECTION

All input and output connections are protected using spark gaps connected directly to a heavy copper bar on the circuit card between the two input terminal strips. The 12 volt power input and charger inputs are protected with transzorbs.

CPU AND INTERFACE

PROCESSOR: HITACHI 6303 CMOS 8 bit microprocessor.

MEMORY: 16k ROM, 4k RAM, expandable in increments of 8k of RAM or ROM up to a total of 64k. Standard 21X stores 896 low resolution data points in Final Memory. 19,200 data points with fully expanded RAM.

DISPLAY: 8 digit LCD (0.5″ digits).

PERIPHERAL INTERFACE: 9 pin D-type connector on the panel for connection to cassette recorder, modem, printer, or RS232 adapter. The serial interface can be programmed for baud rates of 300, 1200, 9600 and 76,800.

CLOCK ACCURACY: ± 1 minute per month.

MAXIMUM PROGRAM EXECUTION RATE: The 21X Programming Table can be executed in sync with real time at a maximum rate of 80 per second. Typical throughput rates allow 1 measurement with linear scaling and transfer to tape at this rate with no interruption.

SYSTEM THROUGHPUT: Data throughput is the rate at which a signal can be measured, processed and stored in Final Memory. The rate is reduced by additional processing or when data is transferred to Cassette Tape or through the 21X serial port.

Throughput to the cassette tape is 100 data values per second. During tape transfer, 25% of the CPU's time is required. Therefore, program execution is uninterrupted if the user-entered program requires less than 75% of the CPU's time.

ASCII data values (10 characters per value) can be transmitted via the serial port at 9600 baud with a throughput of approximately 100 values per second with 15% CPU utilization. Faster throughput rates are possible if CSI's binary format is transmitted (consult factory).

Each time a new measurement instruction is specified, time for two additional measurements is required for self-calibration. Therefore, using more repetitions in fewer instructions increases throughput.

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 15 volts.

TYPICAL CURRENT DRAIN: 1.0 mA quiescent, 25 mA during processing, and 60 mA during analog measurement.

INTERNAL BATTERIES: 8 Alkaline D cells with 7 amp hour capacity. The Model 21XL includes sealed lead acid batteries with 2.5 amp hour capacity per charge.

EXTERNAL BATTERIES: Any 12 volt external battery can be connected as a primary power source with the internal batteries providing backup while changing external batteries.

OPERATION FROM OTHER SOURCES: The Model 21XL includes a battery charging circuit that can be connected to 15 to 30 VDC indefinitely to maintain a full charge on the batteries without degradation. The charging circuit includes temperature compensation for maintaining optimum charging voltage at temperature extremes. A 110 VAC to 16 VDC wall transformer is provided with the 21XL.

PHYSICAL SPECIFICATIONS

SIZE: 8.2″ X 5.7″ X 3.3″. Input terminal strips extend 0.45″ above the panel surface

WEIGHT: 6.2 lbs   Reprinted October 1984

Instant data logging arrives.

Specifications

Analog Input Channels

Number
23 differential or 46 single ended or any mix, internal temperature and zero reference

Ranges
Voltage: ±25 mV,
±250 mV, ±2.5 VDC
Current: ±2.5 mA, ±25 mA,
±250 mA via 100 Ohm shunts
Resistance: 250 Ohm, 2.5 KOhm, 25 KOhm
Frequency: 40 Hz to 20 KHz
Period: 25 mSec to 5 uSec
Temperature: Full support for thermocouple types B, E, J, K, N; R, S and T, RTD's, LM335, LM35, AD590

Analog to Digital Converter
Type: Voltage to Frequency
Resolution: 15 bit (1uV),
13 bit (4uV) stored data
Sample Rate: 6 to 30 samples/sec,
Accuracy: 0.15% standard,
2% attenuated voltage, 1% current
Linearity: < 0.05%
Input Resist: > 100 MOhm
Common Mode
    Range: ± 4V
    Rejection: > 80 db
    Line Reject: > 100 db
Series Mode
    Line Reject: > 35 db

Digital Input Channels

Number: 8. TTL and CMOS compatible

Counter Channels

Number: 8 low speed (share digital inputs), 1 high speed
Upcounters −32767 to 32768, presettable, generate event on zeroth count
Count Rate: Low speed 130 Hz, High speed 2 MHz

Analog Output Channels

Number: 1, expandable to 2
12 bit, 4 quadrant multiplying
Programmable range (± 5V max)

Digital Output Channels

Number: 8. Open collector type, +30 V, 200 mA maximum

Computer/Terminal Interface

Type: RS232C/RS422/RS423, full duplex, isolated
Baud Tx: 150, 300, 600, 1200, 2400, 4800
Baud Rx: 75 or equal to Tx baud rate
Protocol: XOR checksum with ACK/NAK
Handshake: XON/XOFF, ACK/NAK

Real Time Clock

Format: Time hh:mm:ss
Day number ddddd
Resolution: 1 sec, 2 secs stored data

Data Storage

Battery backed 24K CMOS RAM, approx 11000 readings

Power Supply

Voltage: 9-15 VAC, 11-18 VDC
Line/Mains: Via adaptor
Battery: 12 VDC external
Backup: NiCd, internally recharged
Current Draw: <20 mA low power mode, approx 40 mA normal mode

Accessories

110VAC/240V AC adaptor, wire-wrap kit, RS232 cable, I/O plugs, temperature probe, batteries, users manual

Specifications are subject to change without notice

Programming Functions

Scanning: Single Scan, Poll Scan, Repeat Scan, Event Scan, Averaging Scan, Conditional Scan, Channel Inspection, Store to Memory, Unstore Memory
Input Channels: Volts, Current, Resistance, Frequency, Period, Temperature, Digital Bit, Digital Byte, Accumulating Counter, Resetting Counter, Time, Day
Output Channels: Analog Volts, Digital Bit, Digital Byte, Digital Pulse, Control, Alarm
System Configeration: Data Format, Calibration, Gain lock, ADC Parameters, Low Power, Thermocouple/RTD Reference Channels, Communications Protocol, Memory Management, Echo, Set Time, Status, Reset, Clear Memory, Self Test, Network Identify

Datataker's versatile wire wrap I.O. system simplifies many test procedures.
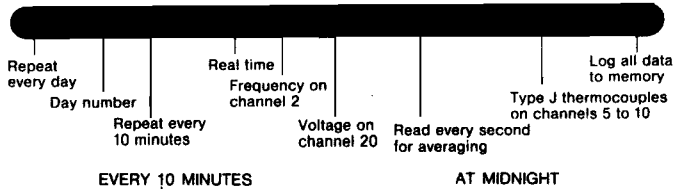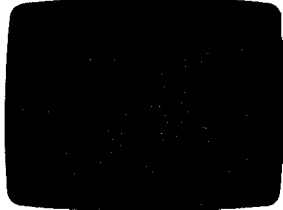
Set up a system in minutes

If you connect three J type thermocouples and want to read them every 2 seconds, then send this simple command from your computer.

Datataker will read the thermocouples and display the data:

Datataker handles complex operations just as easily.

To log the line frequency and voltage every ten minutes, the 10 minute average of each of 5 thermocouples and the time that each sample was taken, simply send the following command.

The Datataker incorporates a real time clock, allowing data to be collected at regular intervals. The day number and time of data collection may also be recorded.

Data may also be collected in response to external events.

Repeat every day	Real time Frequency on channel 2	Log all data to memory

Day number · Repeat every 10 minutes · Voltage on channel 20 · Read every second for averaging · Type J thermocouples on channels 5 to 10

EVERY 10 MINUTES · **AT MIDNIGHT**
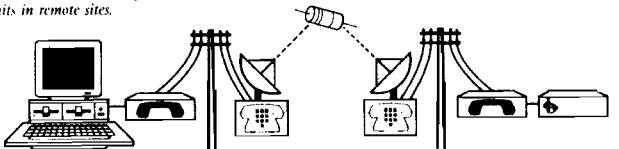
Operation

Once programmed the Datataker operates independently of the computer, and inputs may be scanned at intervals ranging from seconds to months.

The link between the computer and the Datataker may be either direct or via modems, and is necessary only during command or data transfer.

Up to 7300 readings can be stored in the Datataker for later recovery.
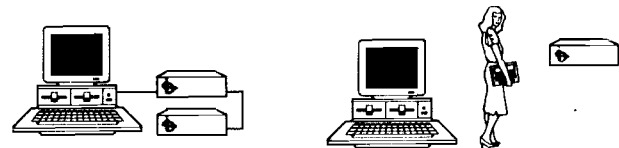
Datataker can be directly connected to a computer or portable computers used to retrieve stored data from units in remote sites.

Using modems and the public telephone network, Datatakers in remote sites can be accessed.

Datataker is a truly flexible tool. A wire wrap panel is provided so input and output connectors can be configured to exact requirements.

Communications

The Datataker communicates with any computer via an RS232/RS422/RS423 interface, at up to 4800 baud. All communications are in standard ASCII.

I/O Connections

I/O lines connect to the Laboratory and Field versions of the Datataker via 25 pin and 5 pin sockets in the rear panel. The Industrial Logger has screw terminals for I/O.

The Datataker has in excess of 200 connection points on a wire-wrap panel, which are used to connect the I/O sockets or screw terminals to required channels. This innovative feature provides considerable flexibility, and allows convenient configuration of the Datataker for any application. A utility area with I.C. socket is also provided for the installation of custom circuits.

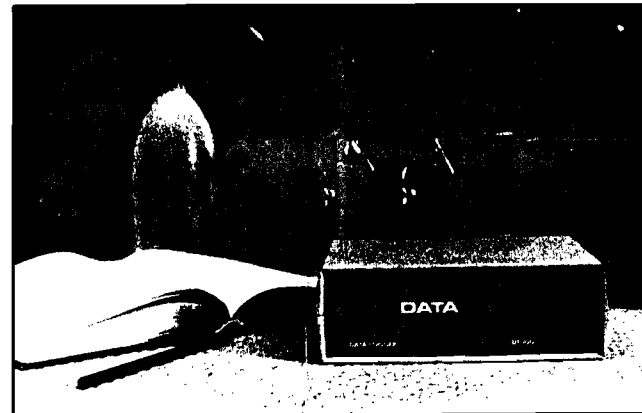*Datataker can be programmed, and stored data downloaded, with a portable computer.*

Networks

Up to 15 Datatakers may be networked via an inexpensive twisted pair cable.

Power Supply

The Datataker may be powered from a variety of sources, including mains or line voltage, batteries, solar panels, wind generators, etc.

The internal batteries are automatically recharged from the external power source.
During periods of low activity, the Datataker switches to a low power mode to reduce power consumption.

Low power CMOS circuitry enables the Datataker to be powered from solar collectors.

Warranty

All critical components are protected against overloads and shorts. Datataker is backed by a twelve month warranty and service is available world wide.

The Datataker Industrial Logger provides convenient screw terminal connectors and splash proof housing.

Built-in averaging facility and counters make the Datataker ideal for meteorological applications.

With a rugged stainless steel case, Datataker is ideal for logging in hostile environments.

Datataker automates recording of laboratory instruments without tying up computers.

Models

All three models have identical data handling capabilities.

	DT100 Laboratory Logger	DT100F Field Logger	DT100I Industrial Logger
Battery Backup	450 mAH 2 days	4 AH 15 days	4 AH 15 days
Width	210 mm/8.25 in	241 mm/9.5 in	250 mm/9.8 in
Height	70 mm/2.75 in	76 mm/3.0 in	355 mm/13.9 in
Depth	165 mm/6.5 in	267 mm/10.5 in	155 mm/6.1 in
Weight	1.1 kg/2.6 lb	3.0 kg/6.6 lb	3.0 kg/6.6 lb
I/O	2 DB25 & 2 DIN Sockets Wire-wrap Panel	2 DB25 Sockets Wire-wrap Panel	Screw terminals Wire-wrap Panel
Case	PVC < 80% RH	Stainless Steel Weatherproof	Polyester Splashproof
Environment	−20 to 55 Deg C	−20 to 55 Deg C	−20 to 55 Deg C

DATA TAKER

DATA LOGGER BY DATA ELECTRONICS (AUST) PTY LTD
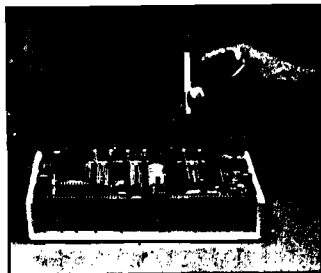
Electronic control and measurement.   Renewable energy systems.

INTRODUCTION

The Dulas Data Logger was specifically designed to monitor small renewable
energy systems, either in the field or laboratory.   It has, however, found
other applications such as remote weather stations and environmental monitor-
ing.   The logger is based upon a pocket sized personal computer to which
interchangeable input signal conditioning modules are attached.   The hard-
ware has been designed to ensure that all the inputs are easy to read by a
BASIC program, allowing users familiar with BASIC to write their own data
collection and analysis programs.   Data may be stored either in battery
backed RAM, on cassette tape, or displayed using the computer's miniature
4 colour graphics plotter.   It can also be transmitted serially via a cable or
radio link.   The system's low power consumption (typically 300mW) enables
it to run for at least two weeks from an optional rechargeable battery pack,
or indefinitely when being charged from a small photovoltaic array.

The computer's data and address busses are extended to a mother board
which can accept up to 8 dual input analogue cards, 8 digital input cards,
and a battery charging regulator card.   The mother board also accomodates
two 8 bit 8 channel Analogue to Digital convertors that give a resolution of
1 part in 256.

INPUT OPTIONS

The data logger can accept up to 16 analogue and 8 digital inputs.   Signal
conditioning modules are interchangeable, and may be easily installed by the
user.
Analogue input modules are available for:

    Solarimeters
    Platinum Resistance Thermometers
    Thermocouples
    Semiconductor temperature sensors (type AD590)
    D.C. voltages (from 5mV full scale upwards)
    D.C. currents (for 60mV, or 200mV shunts)
    Humidity sensors
    Pressure transducers
    Strain guages

2 digital input modules are available, either pulse counting or 8 bit parallel
inputs.   These 2 modules will accept inputs from:-

    Shaft encoders
    Contact closures
    Anemometers (opto-coupled, or reed relay)
    Flow meters
    Wind direction vanes

COMPUTER PROGRAMMING

All input channels are "memory mapped" to appear to the computer as extra
RAM, each input having a unique address.   These addresses may be interrogated
from BASIC using the standard "PEEK" command.   No software initialisation

of the inputs is required.   This approach, coupled with comprehensive
programming manuals allow most users to write their own data logging
programs.   We will, however, be pleased to undertake programming if
required.   For high speed data sampling, machine code routines can be
used to rapidly dump data into RAM.   It can then be easily processed
or output with a simple BASIC programme.   This technique can be used
to provide detailed "snapshots" of transient occurrences.   The computer
can be programmed to monitor a variable or a combination of variables
to determine when such a "snapshot" should be taken, e.g. the study of
windpump blade dynamics during periods of high yaw rate.

POWER CONSIDERATIONS

Power supply voltage: 6V nom (5.8 - 7.3)
Power supply current: 50mA nom, but dependent on the number of input
                      modules and the frequency of printouts.

A 25Ahr, 6V sealed lead acid battery pack is available to ensure at least
2 weeks continuous operation between charges.   Data and programs in
RAM will be retained for up to 12 months by the computer's own dry cells.
Regulator modules are available to charge the batteries from existing higher
voltage supplies, or from photovoltaic arrays available from Dulas.

PACKAGING

The method of enclosing the logger is dependent upon the application.   We
have supplied loggers as "bare board", systems to suit customer's housings,
in "desk top" enclosures, or in fully environmentally sealed boxes.   This
last option measures approx 200x300x400mm without the external battery
pack.

Dulas Engineering is based at the Centre for Alternative Technology, where
the practical problems of integrating electronics into renewable energy
systems have been experienced first hand over the last 10 years.   We are
a small company, happy to adapt our products to individual customers
requirements.   Please contact us for further information about this, and
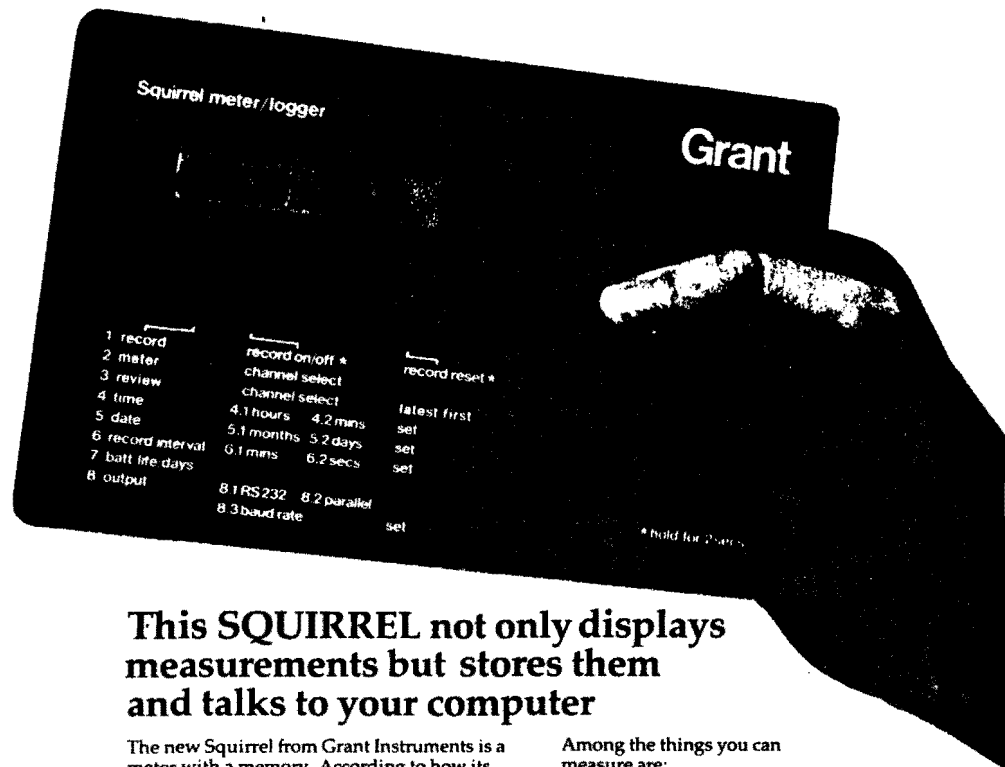other products.

FIELD DATALOGGER
EKO 10 SYSTEM

EKOPOWER
MONARCHSTRAAT 46
5641 GJ EINDHOVEN,
THE NETHERLANDS
TEL.: +31.40.814458
TELEX: 20010 PMS NL
(ATT EKOPOWER)

EKOPOWER

ENERGY SYSTEMS AND MEASURING INSTRUMENTS

Grant

Squirrel meter/logger

Grant

```
1 record
2 meter
3 review
4 time
5 date
6 record interval
7 batt life days
8 output

record on/off *
channel select
channel select
4.1 hours   4.2 mins
5.1 months  5.2 days
6.1 mins    6.2 secs

8.1 RS232  8.2 parallel
8.3 baud rate

record reset *

latest first
set
set
set

set

* hold for 2 secs
```

This SQUIRREL not only displays measurements but stores them and talks to your computer

The new Squirrel from Grant Instruments is a meter with a memory. According to how its microprocessor has been programmed, it will measure any one of a range of variables from voltage to windspeed, gas consumption to solar radiation. In every case, the digital display gives second-by-second readings in appropriate units.

Squirrel will also log the results – from one, two or four inputs. Interval models store readings at user-set intervals between 1 second and 100 minutes. Event models store readings each time a user-selected event occurs.

The Squirrel SQ2 stores 2,000 readings, the Squirrel SQ8 stores 8,000. Date and time are also stored.

Then there is RS232C serial or 8-bit parallel playback for plugging direct into your computer. A portable Epson computer can be used to collect the data or analyse it in the field. Standard analysis programs are available for many types of microcomputer.

Among the things you can measure are:
Voltage
Current
Temperature
Humidity
Pressure
Flow
pH and other ions
Dissolved O_2
Wind direction
Wind speed or run
Rainfall
Pulse counts
Solar radiation
Net radiation
Light intensity
Electricity consumption
Gas consumption

It adds up to an effort-saving, high-precision method of taking measurements, logging the results and transferring data directly to computer.

General Description

A Squirrel Meter/Logger can be used as a meter or a recorder, or both at the same time. It can take a reading from each input every second and display or record readings as selected by the user-set controls.

When used as a meter, the reading from a selected channel is shown on the display, and is updated every second.

When used as a logger, readings are taken from each channel and stored in the memory at user-selected intervals (interval models) or whenever a user-selected event occurs (event models). The word "record" flashes on the display three times a minute during a recording run. Recording is unaffected by use as a meter.

Memory size Model SQ2 can store up to 2000 8-bit readings, Model SQ8 up to 8000. On multi-channel models the total memory capacity is shared between the channels.

Power supply The small non-rechargeable battery is easily available throughout the world. Battery life in the recording mode is about six months: the display shows the number of recording days remaining in the battery.

Controls

Apart from the on-off switch the only controls are three push-buttons, recessed to reduce the risk of accidental operation. The three push-buttons allow the user to start or stop recording or carry out all other functions, including:

– meter, displaying any channel
– review all stored readings, displayed at a rate of 1 per second
– set real-time and date
– set recording interval (interval models) between 1 second and 100 minutes
– select significant events to trigger a recording (event models)
– display battery life in recording days
– set format for output to computer

Data storage and transfer

As well as the readings themselves, the following information is stored for later transfer to a computer:

– recorder reference number
– number of channels, with input type and range for each channel
– date and time of first reading
– recording interval (interval models)
– which events are significant (event models)
– number of readings recorded
– checksum (of all readings)

The push-buttons enable the output to be set as 8-bit parallel, or as RS232C serial with a baud rate of 300, 600, 1200, 2400 or 4800. At a baud rate of 4800, all data is transferred in less than half a minute.

A signal flashes on the display while data transfer is taking place.

Guarantee

Squirrel Meter/Loggers are guaranteed against faulty materials or workmanship for THREE YEARS. Within the United Kingdom we make no charge for labour, materials or carriage when equipment is repaired under guarantee.

Inputs and Ranges

Inputs and ranges are factory-set and cannot be altered after manufacture.

Squirrels can have direct inputs of the type and range described below. Sensors for other variables listed on the front cover cannot be connected directly to a Squirrel: their output must be converted to voltage, current or pulses before being fed to a suitable Squirrel input.

Combinations of input types and ranges

Many different combinations of input type and range are available within the following overall limits:–

All-analogue Squirrels One to four inputs. These can all be of a single type recording on a single range, or they can be split into two groups. All inputs of the same group must be of a single input type and range.

Pulse-counting Squirrels One pulse-counting input, with the option of one analogue input.

Event/digital Squirrels Eight event inputs (which can also be used as a single 8-bit digital input), with the option of up to four analogue inputs. These can be split into two groups as described for all-analogue Squirrels.

Consult the latest price list for details of combinations currently available.

Squirrel meter/logger

Grant
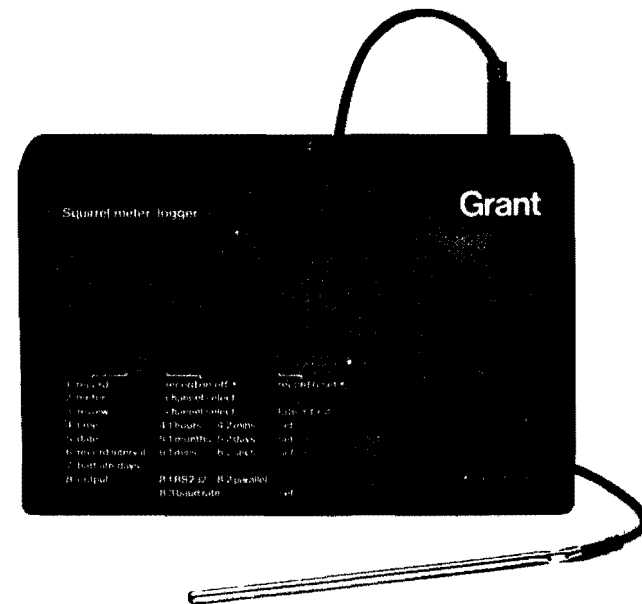
Technical Specifications

Memory

SQ2 2000 8-bit bytes
SQ8 8000 8-bit bytes

Readings stored in the memory are retained for over a year.

Conditions of use

Ambient temperature −30 to +65°C
Ambient humidity up to 95% r.h.
(non-condensing)

Battery

Standard 9V alkaline (Duracell MN1604, etc). Recording life about six months.

Accuracy

Analogue ranges

Resolution: 1 bit (0.4% span)

Accuracy:
− ±1 bit (0.4% span) on V and C ranges
− ±2 bits (0.8% span) on other ranges

On thermocouple ranges there can also be a cold-junction compensation error of up to 0.07°C/°C above or below 20°C Squirrel ambient.

Pulse-counting ranges

Count mode – max error 1 pulse (32 pulses for readings above 32,768)

Rate mode – max error 1 pulse

Event/digital range

Event-initiated mode – No error on "State" reading. Max error 1 time unit on time readings (non-cumulative)

Interval mode – No error

Computer output specification

Output socket 15-pin D

Format (user selected)
either 8-bit parallel
*or* RS232C with user-selected baud rate of 300, 600, 1200, 2400 or 4800 (no hardware handshaking).

Data transfer rate At a baud rate of 4800, all readings from SQ2 are transferred in not more than 8 sec, from SQ8 in not more than 32 sec.

Further details on data transfer are given in "Notes on interfacing Squirrels with computers" available on request. (These notes are also incorporated in the user manual supplied with every Squirrel.)

Input specifications

Code	Type	Socket	Input	Input Impedence	Notes
V	Voltage (d.c.)	3.5mm Øjack (yellow)	Common ground	1MΩ	
C	Current (d.c)	3.5mm Øjack (silver)	Common ground	Depends on range.	100 Ω up to 3mA
U	Mini-thermistor	3.5mm Øjack (red)	Common ground	Depends on range.	33 Ω over 3mA to 10mA
S	Micro-thermistor	3.5mm Øjack (green)	Common ground	Depends on range.	10 Ω over 10mA to 30mA
P2	Pt 100 (2 wire)	3.5mm Øjack (blue)	Common ground	Depends on range.	3.3 Ω over 30mA
P3	Pt 100 (3 wire)	min 3-pin (blue)	Common ground	Depends on range.	
K	Chromel-Alumel t/c	ISA min t/c (yellow)	Floating	1MΩ	
T	Cu-Constantan t/c	ISA min t/c (blue)	Floating	1MΩ	
J	Fe-Constantan t/c	ISA min t/c (black)	Floating	1MΩ	Inputs can be from contacts
L	Rel. humidity	6-pin DIN	Floating	1kΩ	(max frequency 100Hz for pulse-count)
A	Pulse-count	5-pin DIN	Common ground	100kΩ	or voltages with low level less than
D	Event digital	9-pin D	Common ground	22kΩ	0.5V, high level 4 to 20V.
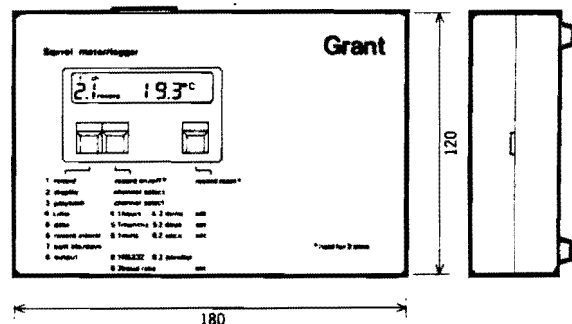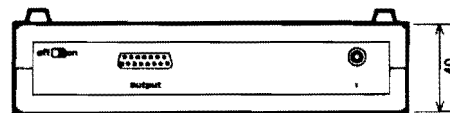
Wt: 0.5kg
Material: Grey Nextel-coated ABS

Mobile Data Logger MODAS 12

with semiconductor plug-in memory

'

MODAS 12 is particulary useful for long-term data acquisition in difficult operating conditions in the factory or in the field, for example:

- o Decentralised monitoring of operating data in the fields of energy supply engineering and energy consultancy, for machinery and process sequences
- o Performance measurement in pilot and demonstration projects
- o Unmanned stations for weather and environmental measurements, site appraisals
- o Mobile application in vehicle testing

in the specialist fields of energy technology, engineering, vehicle technology and geo-sciences (meteorology, geophysics, geography and geodetic surveying).

RAM Plug-in memory

MODAS 12

Data transfer　Personal computer

Floppy and printer
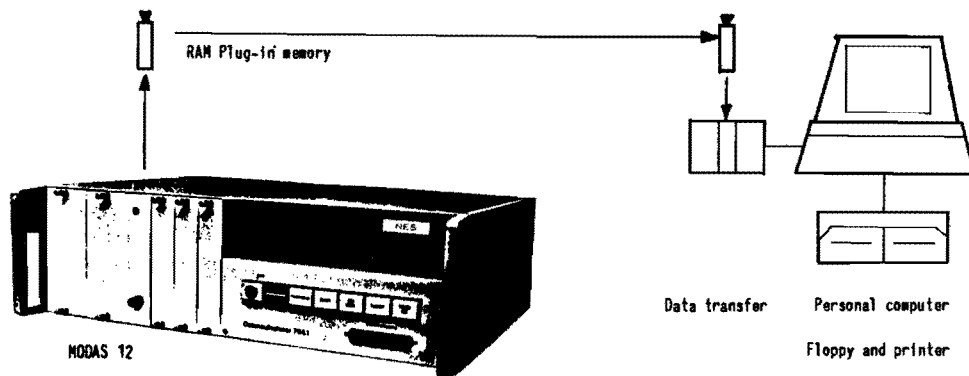
Features:

- Measurement, monitoring and reduction of all physical parameters
- Semi-conductor as data store ensuring a high degree of security for data even in unfavourable environmental conditions (no moving parts)
- 16 analogue and 7 impulse inputs with 12 bit resolution, built-in signal conditioning cards for all the usual sensors, internal data reduction by means of mean values; high degree of flexibility
- Very low power consumption of only 0.5 watt; autonomous supply by means of solar cells
- Robust and good value, low sensitivity to vibration or dust; developed and manufactured in West-Germany, reference installations in Kenya, Peru and the Philippines

Description:

1. Data logger MODAS 12

- 16 analogue and 7 impulse channels; programming of channel allocation, amplification and mean value interval by means of a key board
  Analog: 0.1, 0.5, 2 and 8 volt, with signal conditioning card 5 and 20 mV full scale deflection (12 bit resolution); connection to all usual sensors without the need for any external power supply. Impulse: contact (built-in bounce prot.) or voltage signal, counters 0 -4095
- Scanning of the occupied channels every 2 s, data reduction by means of formation of mean values (1 min to 1 h); display of current values, data formatting, storage place, time and date
- Up to four 8 KB or 32 KB plug-in memories can be connected to the MODAS 12 (max. 128 KB = 130 000 values à 12 bit); measurement period with an 8 KB memory and 16 channels occupied (hourly mean values) is almost three weeks, with a 32 KB memory nearly 3 months; data security approx. 10 years due to integral LiCl battery
- Voltage supply: built-in 12 V/9.5 Ah battery, charging by internal power pack or solar charge regulator: power consumption only about 0.5 watt
- 19 inch rack mounting, 3 height units, working range -20 to 55°C, up to 90% r.H. non cond.

2. Readout and transmitter unit DLU

- Readout of the RAM memory and delivery of the measured values to a personal computer
- Serial (RS 232C V.24) or parallel (IEEE 488, IEC-Bus) interfaces

3. Accessories

- Hardware: 8 KB and 32 KB plug-in memories, built-in signal conditioning cards for all usual sensors, aluminium case for transport and installation of MODAS 12 in the field, solar cell module to provide an independent power supply for MODAS 12 in the field; personal computer, floppy and printer for laboratory and office, hand-held computer for provisional evaluation in the field
- Software: transfer software for serial and parallel interfaces, processing software (at present only available for Commodore personal computer): conversion to physical parameters, storage, printout, collation into monthly files, statistics, graphics

4. Optional extras

- Expert advice on the selection of necessary sensors and adaptability of MODAS 12 to the available hardware
- System selection and integration: MODAS 12 - sensors - personal computer - software
- Leasing of MODAS 12: contract measurements with install. and dismantl., evaluation and report
- A wide range of special requirements can be met, e.g. storage of min/max values, standard deviation; direct storage of measurements without formation of mean values; multiplication of the instantaneous values of two channels for measurement of power and heat quantities; 9 further channels possible for digital purposes (e.g. status, BCD)

5. References

References from areas of application at home and abroad such as those mentioned overleaf. Exreme, all-year round operation without connection to the grid including high mountain ranges (Peru 3,800 m, France and Switzerland 2,500 -3,200 m, Austria 2,600 m) and developing countries (Kenya, Peru and the Philippines); genuinely mobile applic. in vehicle testing

Further technical details, examples of software and prices from: