

POWER MONITOR INSTALLATION AND MAINTENANCE

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1. GENERAL

1.01 This section covers the installation and maintenance of the Cyclomatic Model 4002 Power Monitor, which was standardized by Pacific Telephone Engineering Letter (PTEL) 2167.

1.02 (Reserved for future use.)

1.03 The Model 4002 is for application in small Step-by-Step central offices that use Small Office Network Data Systems (SONDS) for traffic data collection. The Power Monitor converts the millivolt potential, generated at load ammeter shunts, to pulses counted by traffic measurement devices (peg count registers).

2. DESCRIPTION

2.01 The Cyclomatic Model 4002 is a solid state device that monitors the voltage drop across the DC power plant load meter shunt. This voltage is converted into a series of pulses which represent the average current drain during the data collection interval and is transmitted to the traffic data collection system.

2.02 The input signal voltage range from the load ammeter or shunt is selectable from 0-50 mV or 0-100 mV. The Model 4002 is programmable by means of a 10-second Dual In-line Package (DIP) switch that permits the selection of input voltage, output data collection interval and output scaling. The Model 4002 accommodates data collection intervals of an hour, a half hour, or quarter hour.

A. Relationship of Output Pulse Rate to Reading

2.03 The Model 4002 output pulse rate is directly proportional to the reading. An intermediate reading going into the average for the data collection interval can be determined by observing the interval between output pulses or pulses per time unit. The pilot light blinks off to indicate when an output pulse is occurring.

2.04 If it is desired to produce a readout in percent of full scale, the DIP switch should be operated for a full scale reading of 100 for a 50 mV shunt (Table A) or a 100 mV shunt (Table B). A setting of 100 gives a resolution of 1%; selecting a full scale reading of 1000 gives a readout resolution of 0.1%; a reading of 10,000, 0.01%.

NOTICE

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Bell System except under written agreement

TABLE A
FOR 50 mV FULL SCALE INPUT
STANDARD FULL SCALE READINGS &
ASSOCIATED DIP SWITCH SETTINGS

FULL SCALE READING	DIP SWITCH SETTING							
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
	40	O	X	O	X	X	X	X
50	O	O	O	X	O	O	X	X
80	X	O	X	X	X	X	X	O
100	O	O	X	O	O	X	X	O
125	O	O	O	O	X	O	X	O
200	O	X	O	O	X	X	O	O
250	O	O	O	X	O	X	O	O
400	X	O	O	X	X	O	O	O
500	O	O	X	O	X	O	O	O
625	O	O	O	O	X	O	O	O
1000	O	X	O	X	O	O	O	O
1250	O	O	O	X	O	O	O	O
2000	X	O	X	O	O	O	O	O
2500	O	O	X	O	O	O	O	O
5000	O	X	O	O	O	O	O	O
10000	X	O	O	O	O	O	O	O

FOR ANY FULL SCALE INPUT
DATA COLLECTION INTERVALS &
ASSOCIATED DIP SWITCH SETTINGS

DATA COLLECTION INTERVAL	DIP SWITCH SETTING	
	<u>9</u>	<u>10</u>
1 HOUR	X	O
½ HOUR	O	X
¼ HOUR	O	O

X = SWITCH CLOSED. SWITCH IS CLOSED WHEN END OF ROCKER NEAREST COVER IS DOWN.

TABLE B
FOR 100 mV FULL SCALE READINGS &
ASSOCIATED DIP SWITCH SETTINGS

FULL SCALE READING	DIP SWITCH SETTING							
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
80	O	X	O	X	X	X	X	X
100	O	O	O	X	O	O	X	X
160	X	O	X	X	X	X	X	O
200	O	O	X	O	O	X	X	O
250	O	O	O	O	X	O	X	O
400	O	X	O	O	X	X	O	O
500	O	O	O	X	O	X	O	O
800	X	O	O	X	X	O	O	O
1000	O	O	X	O	X	O	O	O
1250	O	O	O	O	X	O	O	O
2000	O	X	O	X	O	O	O	O
2500	O	O	O	X	O	O	O	O
4000	X	O	X	O	O	O	O	O
5000	O	O	X	O	O	O	O	O
10,000	O	X	O	O	O	O	O	O

X = SWITCH CLOSED. SWITCH IS CLOSED WHEN END OF ROCKER NEAREST COVER IS DOWN.

2.05 To produce a reading in amps, for example, the DIP switch is set according to Table A (50 mV shunt) or Table B (100 mV shunt) for a 400 amp full scale reading, and for a data collection interval of either ¼ hour, ½ hour, or an hour.

2.06 For a full scale reading of 10,000 amps, 50 mV across a 50 mV shunt, or 100 mV across a 100 mV shunt, will produce 10,000 pulses during the data collection interval selected.

B. Shunt Divider Scaling Modules

2.07 Four shunt divider scaling modules are provided by Cyclomatic Industries as shown in Table C.

**TABLE C
MODULES FOR ADJUSTING
AMMETER SHUNT SCALING**

STANDARD SHUNT DIVIDER SCALING MODULES					
This table lists part numbers and related 4002 DIP Switch settings for modules providing readout in amps using various shunts whose ratings do not correlate with standard 4002 full scale readings.					
Shunt Rating (Amps)	50mV SHUNT		100mV SHUNT		Order Module Part Number Listed Below
	4002 DIP SWS Closed (Note 2)	Readout Error (Note 3)	4002 DIP SWS Closed (Note 2)	Readout Error (Note 3)	
600A	5	± 5A	6	± 5A	450310-96
800A	3.4	± 7A	Note 4	—	450310-96
1200A	4	± 9A	5	± 9A	450310-96
3000A	1.2	± 23A	2.3	± 21A	450310-90
4000A	2	± 34A	Note 4	—	450310-80
6000A	1	± 66A	2	± 40A	450310-60
8000A	1	± 66A	2	± 53A	450310-80

Notes

- All modules provide 1 amp. readout resolution.
- In addition to closing switches listed in table, close 9 if data interval is 1 hour, 10 if data interval is ½ hour. Open both 9 and 10 for ¼ hour. Switches are closed when end of rocker nearest cover is down.
- Error specification is entire system maximum error, excluding tolerance of shunt itself, over 25 ± 10°C. Specification applies to both Traffic Data System and 4020 Digital Display readouts.
- Can use 4002 without module for this combination.
- All modules divert 0.5mA around 50mV shunt or 1mA around 100mV shunt. Because of this current it is preferable to locate the module at the shunt rather than at the 4002.

Part Number System for Standard and Special Modules

450310-XX
 — Module output in mV when input is 100mV.

C. Classification Information

2.08 The Continuing Property Record (CPR) number for the Cyclomatic Model 4002 Power Monitor is 369785; for the special features and mounting hardware, 099999.

D. Miscellaneous and Mounting Hardware

2.09 Among the special features available are:

- Special full scale reading (10,000 maximum — the value *must* be specified).
- Special input voltage range (10 V maximum — the value should be specified).

2.10 The following mounting hardware is available:

Part Number	Description
	Flange Mount — for mounting in cabinet face
450136-1	19 inch Rack-Mount Kit, 1¾ inch high, equipped with cutouts for three units
450137-1	23 inch Rack-Mount Kit
450138-1	30 inch Rack-Mount Kit
450127-1	Extension Bracket Kit — extends rack-mount 5 inches in front of rails
450129-1	Blank Front Plate
450139-1	Flange Mount Hardware Kit

2.11 Order the above equipment from:

Austin Tel-Mar Inc.
 31125 Via Colina, Suite 908
 Westlake Village, CA 91362
 (213) 889-9236

Note: Refer to System Instruction (SI) 70, Section 2 for further information on purchasing General Trade Products (GTP).

E. Warranty

2.12 Cyclomatic Industries, Inc, warrants their products against defects in material and workmanship for a period of one year from the date of shipment, provided the equipment is installed and operated according to the manufacturer's instructions.

2.13 Should the unit and/or its associated hardware develop such defects during the warranty period, it will be repaired or replaced at Cyclomatic's option provided the part(s) are returned to their facilities at 7520 Convoy Court, San Diego, CA, 92111. The equipment must be shipped prepaid with an explanation of the failure mode.

F. Repair and Return

2.14 All defective Cyclomatic equipment should be returned, shipment prepaid to:
 Cyclomatic Industries, Inc.
 7520 Convoy Court
 San Diego, CA 92111
 (714) 292-7440

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2.15 All repair requests should include appropriate documentation including diagnosis or explanation of failure or malfunction.

3. INSTALLATION

A. Mounting

3.01 To mount the power monitor in special relay panels supplied as accessories to the Model 4002, remove the front plate from the 4002 by removing two screws, then reinstall it with the rack panel sandwiched between the 4002 and the front plate. Square up the front plate as the screws are tightened. Any special considerations for mounting options are covered in instructions supplied with each option. Blank front plates are available for covering unused panel openings in applications where appearance is important. The rack mounting panels come with matching panel mounting screws.

3.02 When mounting in existing panels, the 4002 is mounted by clamping the panel between the 4002 and its front plate. However, in this case, it is necessary to drill three holes; two for the mounting screws and one to let the pilot light shine through. Drawing 450135, supplied with each 4002, has instructions and a hole locating template. Since the front plate will cover the holes, they don't have to be neat, but they should be free of burrs.

3.03 The flange-mounting configuration can be obtained either by ordering the 4002 with flange mount option or converting a standard 4002 by installing a flange-mount plate in place of the front plate. In this configuration the 4002 is mounted "front first" against any mounting surface that can provide a 1.75 inch by 7 inch footprint area with two No. 10 mounting screws spaced 6.250 inches and centered within the footprint area. The 4002 is not sensitive to mounting position. Since the front pilot is covered up in this configuration, the 4002 is provided with a second pilot light visible from the rear. The flange-mount option is useful when mounting 4002s inside of AC power distribution panels or other cabinets.

B. Wiring

3.04 All connections from the 4002 are made on a terminal block on the back of the unit. Five of the block's six terminals are *always* used; the sixth is used only when the system includes certain option modules. No. 22 American Wire Gauge (AWG) wire is recommended, stranded or solid. The maximum size the terminal block can accept is No. 12 AWG.

3.05 Connections for the Model 4002 without the use of an input scaling module are shown in Exhibit 1, with an input scaling module, in Exhibit 2.

4. MAINTENANCE TEST

4.01 If the Power Monitor is already in service, the local network administrator should be advised before performing this test, since the output from the Power Monitor to the SONDS will be greatly distorted.

4.02 The only equipment required for this test are a voltmeter with a 100 millivolt scale and a watch with a sweep second hand. Connect the voltmeter across the input (leads S+ and S-). The millivolt value of the ammeter shunt should be observed while measuring the blink rate of the Power Monitor pilot lamp.

4.03 However, it may be necessary to operate the DIP switch to a value other than the full scale of the ammeter being read. For example, a 10,000 ampere load over a 15-minute data collection interval will produce an imperceptible 11 pilot lamp blinks per second. In this case, a convenient method would be to set the DIP switch for a full scale of 1000 amps and a 15-minute data collection interval. With this arrangement, a 10,000 amp load would produce an easy-to-count pulse rate of 1.1 per second.

4.04 The shunt voltage is converted into the expected pulse rate using the following formula:

(a) Determine the percent of full scale by dividing the voltage across the shunt by the full scale value (50 mV or 100 mV).

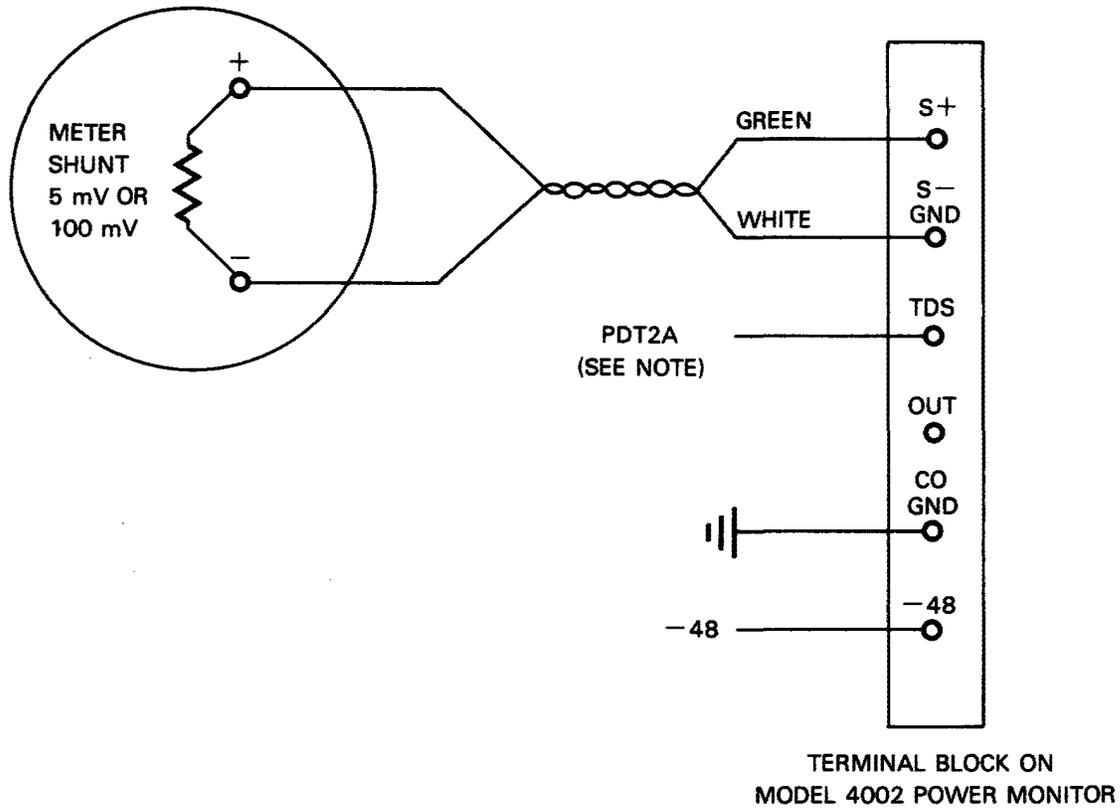
(b) The percent of full load is then converted to an amperage value by multiplying the full scale amperage by the load percent. This value should match the number of blinks over the 15-minute period.

4.05 For example, a 50 mV shunt reads 38 mV on the voltmeter.

(a) $38/50 = 0.76$. Assuming the full-scale ammeter reading is 1000 amperes, then:

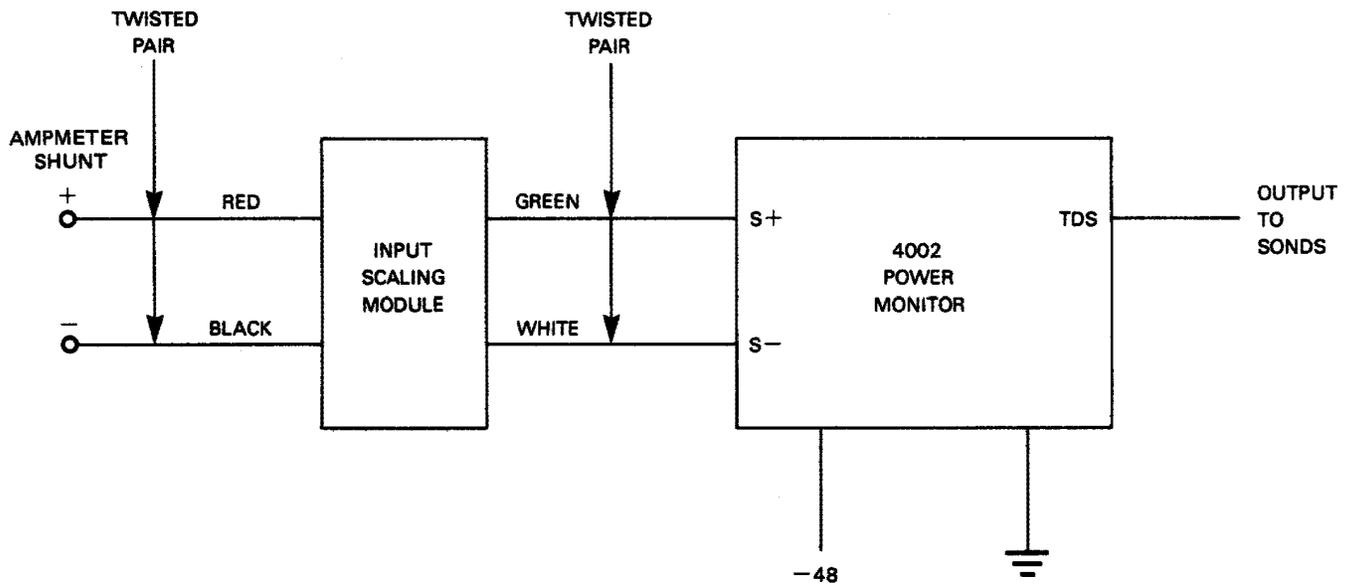
(b) $0.76 \times 1000 = 760$ amperes. Therefore, the number of blinks should be 760 during the 15-minute data collection interval, or 253 ± 3 during the 5-minute test period. It should be pointed out, however, that this blink, or pulse count, represents the *average* voltage across the shunt during the observed period.

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Note: The Network Design Engineer should reserve one peg count lead to peak register for each power plant to be monitored. The register must be assigned to the SONDS Miscellaneous Section with Periodic Average (PA) analysis in the SONDS data base.

**Connections for Model 4002 Without Input Scaling Module
Exhibit 1**



Notes

1. The No. 18 AWG green and white pigtail leads are to be spliced to a twisted pair terminating on the power monitor.
2. All modules divert 0.5 mA around a 50 mV shunt or 1 mA around a 100 mV shunt. Because of this current it is preferable to locate the module at the shunt rather than at the 4002.

**Connections When Using an Input Scaling Module
Exhibit 2**