CSI CONTROL SCIENCES INCORPORATED

DIGITAL SYNCHRO/RESOLVER METER
PANEL MOUNT 4 DECADE

DPM-401

FEATURES:

- **Bright 0.56” LED display**
- **1.9”h x 3.8”w panel space**
- **Only 3” panel depth**
- **0.1° resolution**
- **±0.2° accuracy**
- **Single +5V power**
- **3-state BCD output**
- **Bipolar or Unipolar operation**
- **No Adjustments or Warm-up**
- **Optional Serial PC Interface** ← New!

APPLICATIONS:

- **Antenna Range Instrumentation**
- **System Test**
- **Portable Test Equipment**
- **Aircraft Heading Display**

General Description

The DPM-401 is a small lightweight 4 decade synchro or resolver angle indicator. The meter features a large, bright, easy to read LED display with a wide viewing angle. Angular ranges of either 0° to 359.9° (Unipolar) or 0° to ±180° (Bipolar) can be selected via the rear panel connector.

A tracking synchro or resolver to BCD converter is the heart of the panel meter. The unit uses radiometric conversion techniques, and employs a Type II tracking loop that insures high noise immunity and jitter free operation. The parallel 4 decade BCD angle plus sign is available through the rear panel connector. Two 8 bit bytes or a single word output simplify inter-connection to a microprocessor data bus.

An optional RS232 or RS422 interface is available, allowing importing angular data into a PC. Unipolar or Bipolar output can be selected, independent from the meter display and the rear panel connector. Updates can either be on angle change, or at a continuous 60Hz rate.

Mounting is easily accomplished. All necessary hardware and mating connectors are supplied. The DPM-401 measures only 1.88” x 3.76” x 3.08” deep and requires only +5V power.

Digital Outputs

BCD Output (0.1°—200°)

The 4 decade BCD and sign bit outputs are available via two 8 bit bytes or a single 15 bit word. The two most significant decades plus the sign bit are on one byte, while the two least significant sign decades are on the other byte. The BCD output may also be presented as a single word. The outputs are 3-state compatible TTL positive logic.

Converter Busy (CB)

Whenever an input angle change occurs, the converter changes the BCD output angle in steps of one LSB and generates a 1-3 µsec CB pulse that brackets the code change. During the CB time, BCD angle data should not be transferred. The converter will ignore an Inhibit command applied during the CB interval.

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DIGITAL REAR PANEL INPUTS

Inhibit (INH)

The inhibit input is used to latch the BCD outputs. When INH is at a logic "1" or open, the BCD output tracks the synchro or resolver input. Grounding or setting INH to logic "0" latches the BCD output. The BCD output can be latched indefinitely without interrupting the converter tracking loop or the displayed angle. A simple method to interface with the BCD data is: (a) set INH to logic "0", (b) wait 3 µsec, (c) transfer BCD angle, and (d) set the inhibit back to logic "1". The INH does affect the serial output. However, if in 60Hz update mode, the serial output will still occur, but the angle will not change.

Enable (ENM & ENL)

Two 3-state enable inputs are provided. ENM controls the two most significant decades plus the sign bit and ENL controls the two least significant decades. Logic "0" or ground enables the outputs and logic "1" or open sets the outputs to their high impedance state.

Mode (MODE)

The mode input is used to set the display and BCD output range. A logic "0" or open sets the unipolar range, 0° to 359.9°, and a logic "1" sets the bipolar range, 0° to ±180°. The mode pin does not affect the serial output.

Display Hold (DH)

A logic "1" or open enables the display. A logic or ground, applied to this input holds the last displayed reading. This input does not affect the digital BCD or the serial outputs.

Lamp Test (LT)

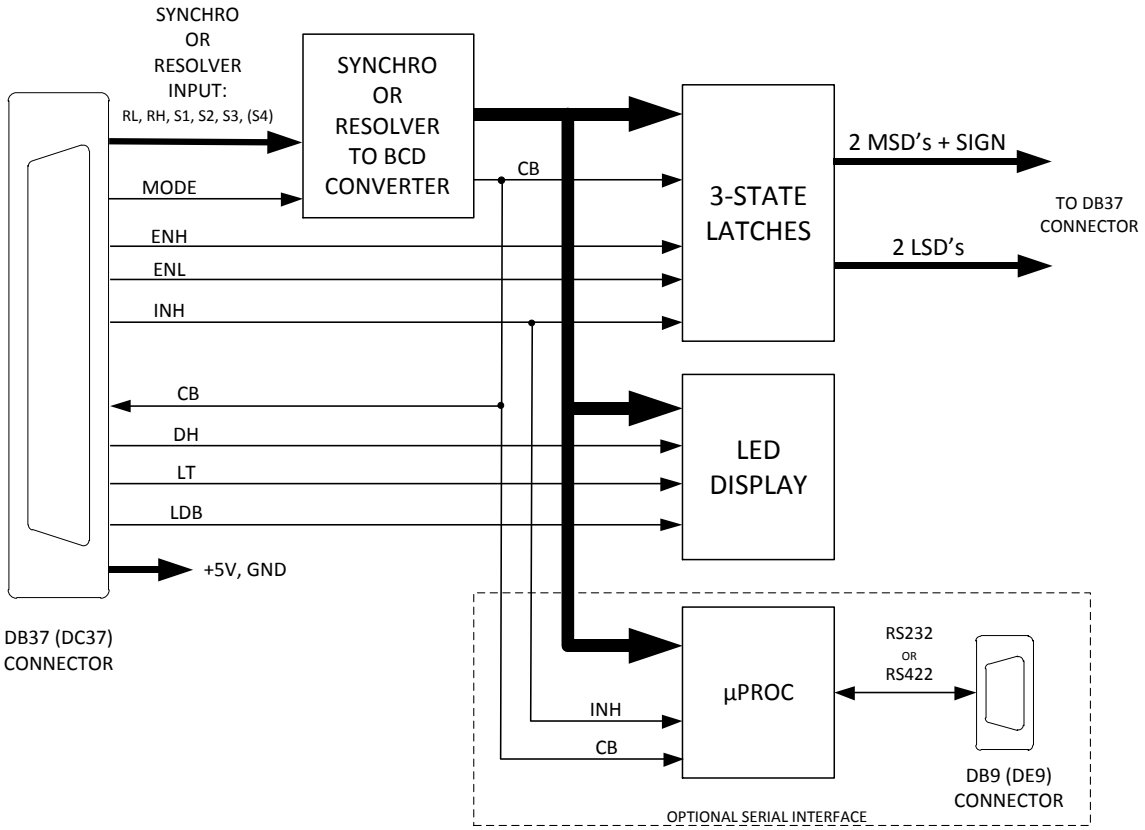
This input is used to test all lamp segments. A logic "1" or open allows normal display operation. A logic "0" or ground illuminates all lamp segments. This input does not affect the digital BCD or the serial outputs.

Last Digit Blanking (LDB)

In some applications, the tenth's digit may not be necessary. Setting the LDB input to logic "0" or ground blanks the tenths digit and the decimal point. A logic "1" or open enables full four decade operation. This input does not affect the digital BCD or the serial outputs.

SPECIFICATIONS

Accuracy	
Full Range	±0.2°
Near Zero	±0.1°
Angle Range	
Unipolar	0° to 359.9°
Bipolar	0° to ±180°
Display	4 decade + sign
	0.56" 7 segment LED
Reference Input	
Type	Solid state differential
Voltage	2.5 to 130VRMS
Frequency	
Synchro	47 to 1200Hz
Resolver	47 to 2600Hz
Impedance	220KΩ, single ended
	440KΩ, differential
Harmonic Content	10% max.
Stator Input	
Type	Synchro or Resolver
	Solid state differential
Voltage (L-L)	2.5 to 115VRMS
	(See ordering information)
Impedance	(V_{L-L}) x (9KΩ)
Phase Shift	±10° max.
Dynamics	
Tracking Rate	3600°/sec.
Settling Time	0.6 sec (179° step)
Acceleration (Ka)	2000 sec^{-2}
Digital Inputs	
Loading	0.5 std TTL loads max
Inhibit	"1" or open = BCD tracks
	"0" or GND = BCD latched
Enable	"1" or open = BCD @ Hi-Z
	"0" or GND = BCD enabled
Mode	"0" or open = Unipolar
	"1" (> 4V) = Bipolar
Display Hold	"1" or open = display enabled
	"0" or GND = display hold
Lamp Test	"1" or open = display enabled
	"0" or GND = all segments on
Last Digit Blanking	"1" or open = 4 digit display
	"0" or GND = 3 digit display
Digital Outputs	
Drive Capability	5 TTL loads max
BCD Angle	4 decade parallel BCD angle
	3-state positive logic
Sign Bit	"0" = + "1" = -
Converter Busy	1 to 2 µsec positive pulse
Power Input	
Voltage	+4.75V to 5.25V
Current	0.2A max, 0.085A typ
Temperature Range	
Operating	0° to +70°C
Storage	-40° to +85°
Physical	
Dimensions	1.88" x 3.76" x 3.08"
Weight	8.0 oz (Add 2.0 oz for serial option)



DPM-401 BLOCK DIAGRAM

PIN #	SIGNAL	DESCRIPTION	PIN #	SIGNAL	DESCRIPTION
1	+5VDC	Power Input	20	GND	Ground
2	R_L	Reference Lo	21	N/C	No Connect
3	R_H	Reference Hi	22	N/C	No Connect
4	MODE	LED Display Mode (0 = Unipolar)	23	N/C	No Connect
5	S4	S4 Input (Resolver only)	24	S3	S3 INPUT
6	S2	S2 Input	25	S1	S1 INPUT
7	N/C	No Connect	26	N/C	No Connect
8	N/C	No Connect	27	ENL	Enable 2 LSD's (0 = Enabled)
9	ENM	Enable 2 MSD's, SIGN (0 = Enabled)	28	DH	Display Hold (0 = Display Hold)
10	LDB	Last Digit Blanking (0 = Blank)	29	LT	Lamp Test (0 = All Segments On)
11	CB	Converter Busy (1 = Busy)	30	INH	Inhibit (0 = Inhibit)
12	0.1°	BCD Fraction Digit LSB	31	0.2°	BCD Fraction Digit LSB + 1
13	0.8°	BCD Fraction Digit MSB	32	0.4°	BCD Fraction Digit MSB -1
14	1°	BCD One's Digit LSB	33	2°	BCD One's Digit LSB + 1
15	4°	BCD One's Digit MSB - 1	34	8°	BCD One's Digit MSB
16	10°	BCD Ten's Digit LSB	35	20°	BCD Ten's Digit LSB + 1
17	40°	BCD Ten's Digit MSB - 1	36	80°	BCD Ten's Digit MSB
18	100°	BCD Hundred's Digit LSB	37	200°	BCD Hundred's Digit MSB
19	SIGN	Sign Bit (1 = "-")			

DB37 CONNECTOR PIN ASSIGNMENT

SERIAL INTERFACE

The DPM-401 is available with an optional serial interface. Either RS232 or RS422 signal format is available. The 3-wire interface protocol is used for this interface. All communication is done using ASCII characters. Various interface cables available allow connection to a standard USB port.

Serial Port Settings

The serial port setting used is 115200/8/N/1.

Handshaking

No handshaking is required, although XON/XOFF type control is provided (see below).

Angle Mode

The serial angle output format can be set to Unipolar to Bipolar format using the MD command. Note that this is independent from the MODE pin on the DB37 connector. The U, B characters are used to set the Angle Mode. The current angle is always re-transmitted when the Angle Mode is changed.

Update Format

The output update format can be changed using the DELTA, CONT commands. D selects angle data transmission only when the input angle to the DPM changes, while C selects angle data outputs at a continuous 60Hz rate.

Angle Output Enable

The serial angle output can be halted or resumed using the HALT, TRACK commands. H (or Cntrl-S) halts angle data transmission after the end (LF) of the current angle being sent. T (or Cntrl-Q) resumes angle data transmission. Note that if a Track command is sent, and the DPM-401 is in DELTA update format, no angle data is sent until the next angle change.

Version

The VERSION command reads the firmware version of the uProcessor in the DPM-401. The VERSION command will only be recognized if the output is halted using the HALT command. The response is a V, followed by the current firmware revision.

SERIAL INTERFACE SPECIFICATIONS:

Serial Interface Parameters

Baud Rate	115200 bits/sec
Data Bits	8
Parity	None
Stop Bits	1
Data Format	ASCII

Angle Update Rate

DELTA Mode	760uS min (DB37 Mode = Serial Mode)
DELTA Mode	1mS min (DB37 Mode ≠ Serial Mode)
CONT Mode	16.67mS

RS232

TX Voltage Swing	±9V typ, ±5V min (with 3kΩ load)
ESD Protection	±15kV

RS422

Differential Driver Output	2.0V min. (with 50Ω load)
ESD Protection	±15kV

Connector

DB9 (DE9) Female

PIN #	SIGNAL	DESCRIPTION
1	N/C	No Connect
2	TXD	Transmit Data (Out)
3	RXD	Receive Data (In)
4	N/C	No Connect
5	GND	Ground
6	N/C	No Connect
7	CTS	Clear To Send (Input Not Used)
8	RTS	Ready To Send (Output High)
9	N/C	No Connect

DB9 CONNECTOR PIN ASSIGNMENT (RS232 OPTION)

PIN #	SIGNAL	DESCRIPTION
1	RXD+	Receive Data + (In)
2	RXD-	Receive Data - (In)
3	TXD+	Transmit Data + (Out)
4	TXD-	Transmit Data - (Out)
5	GND	Ground
6	RSVD	Reserved
7	N/C	No Connect
8	N/C	No Connect
9	N/C	No Connect

DB9 CONNECTOR PIN ASSIGNMENT (RS422 OPTION)

Commands from PC to DPM:

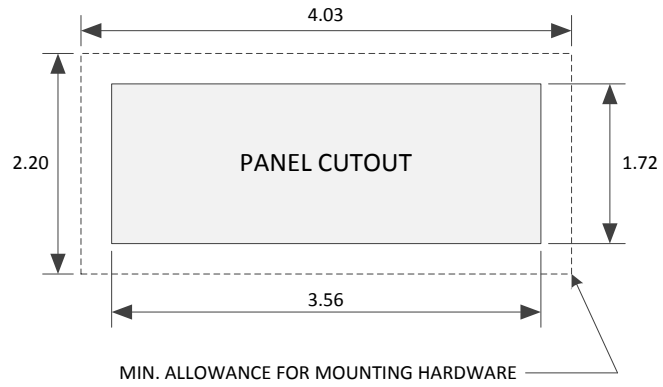
ASCII	Command	Description
B, b	BIPOLAR	Sets DPM Serial to Bipolar output
U, u	UNIPOLAR	Sets DPM Serial to Unipolar output
V, v	VERSION	Requests DPM Firmware Version (Only recognized by DPM after a HALT command)
C, c	CONT	Sets DPM to 60Hz continuous output mode
D, d	DELTA	Sets DPM to output only when angle changes
DC3 (^S), H, h	HALT	Halts output of angle data after complete angle data set
DC1 (^Q), T, t	TRACK	Resumes tracking output of angle data

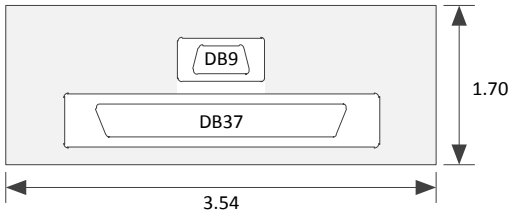
Data from DPM to PC:

ASCII	Data	Description
±, H, T, O, ., Tn, CR, LF	ANGLE	DPM Angle Output: First character is always a "+" (2BH) or a "-" (2DH) Second character (Hundreds) is "0-3" (30H - 33H) Third character (Tens) is "0-9" (30H - 39H) Fourth character (Ones) is "0-9" (30H - 39H) Fifth character is a Decimal Point (2EH) Sixth character (Tenths) is "0-9" (30H - 39H) Seventh character is a CR (0DH) Eighth character is a LF (0AH)
V,n	VERSION	DPM Firmware Version: First character is always a "V" (56H). Second character is "1-9" (31H - 39H). Note: This is in response to a VERSION command from the PC, and will only occur if, prior to the VERSION command, the DPM received a HALT command.

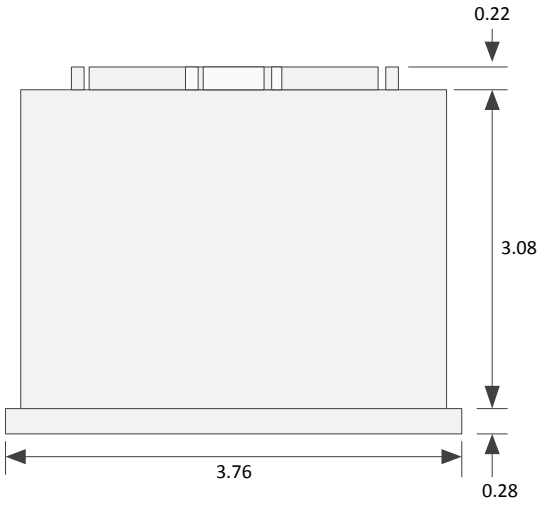
DPM-401 Serial Command Summary

MECHANICAL OUTLINE (NOT TO SCALE, DIMENSIONS IN INCHES)





REAR VIEW



TOP VIEW

ORDERING INFORMATION

DPM - 401 X - XXX - XX

- SERIAL OPTION CODE
  - S1 - RS232
  - S2 - RS422
  - LEAVE BLANK FOR NO SERIAL INTERFACE
- SIGNAL L - L VOLTAGE
- INPUT TYPE
  - S - SYNCHRO
  - R - RESOLVER
- FAMILY CODE

NOTES:

1. All instruments are supplied with mating connectors, connector locking hardware, and panel mounting hardware.
2. Consult factory for special requirements.
3. Specified Signal L-L Voltage tolerance is +10%, -20%

WARRANTY

All units warranted against defects in materials and workmanship for 1 year from date of shipment. Liability is expressly limited to servicing, adjusting, or replacing any CSI product returned to our factory with delivery charges prepaid. In no case shall our liability exceed the original purchase price.

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