



DM7-14BIT Single-Turn, Single Channel Resolver Decoder

Instruction & Operation Manual

Sales and Marketing ▼

343 St. Paul Blvd.
Carol Stream, IL 60188
Tel: (630)668-3900
FAX: (630)668-4676

Factory Customer Service/Order Entry ▼

4140 Utica Ridge Rd.
Bettendorf, IA 52722
Tel: (319)359-7501
(800)711-5109
FAX: (319)359-9094

Application Hotline

1 (800) TEC-ENGR (832-3647)

Visit our web site at: www.avg.net

Programmable Resolver Decoder

Single Turn, Single Channel

Instruction Manual

The DM7 Decoder

Principle of operation

The DM7 series resolver to digital decoder provides an absolute encoder system in conjunction with any one of the Autotech's single turn resolvers. As shown in the diagram on the next page, the resolver rotor winding is excited from a reference sinusoidal generator inside the DM7 unit. The analog output signals from the resolver stator windings, after signal conditioning in the buffer amplifiers are decoded to digital format in the ratiometric tracking converter. The zero offset entered from the front panel keypad is continuously added to this digital value. The offsetted digital data is scaled, converted to the digital format as selected from the keypad and displayed on the front panel of the unit. The position information is also made available in a parallel format for external devices, such as P.L.C.'s remote displays, etc.

Programmable full scale offset for easy set up

The resolver can be mounted on the machine without any concern for mechanically aligning the resolver zero to the machine zero. Once resolver is coupled to the machine shaft, the only thing you have to do is to bring the machine to a known position, say home position, and set an offset number from the front panel keypad until the display reads zero position. This is especially useful during initial start up in that it reduces the set up time. The offset can also be used to compensate for any machine wear.

Programmable resolution; 20-16384 counts per turn

The programmable scale factor feature provides you the flexibility of selecting the resolution in the field. Now you do not have to worry about defining the resolution at the time of ordering the unit. The scale factor can be programmed from the front panel and can be any number between 19 and 16383 resulting in resolution of 20 to 16384 counts per turn. This feature allows you to scale the position to desired engineering units (inches, mm etc) if required.

Front panel selectable output formats — BCD, binary or gray code

The DM7 is an extremely versatile resolver to digital decoder. Now you do not have to define the output format at the time of ordering the unit. Depending upon your application, the output format such as BCD, Natural Binary or Gray code can simply be selected from the front panel keypad. This means one unit for various applications.

Built-in PC synchronization

PC synchronization is built in as standard in DM7 resolver to digital decoder. Depending upon the application it can be selected from the front panel keypad to operate with or without P.L.C. synch circuit. When selected to operate with P.L.C. synch circuit, it provides an error free method of interfacing BCD or binary position data from the decoder to any P.L.C. in the market. Upon receipt of a data transfer command from the P.L.C. the stable data is latched and made available to the P.L.C.

When selected to operate without P.L.C. synch circuit (transparent or microfreeze mode), the position data is continuously updated. At the data transfer command from a microcomputer, the data is latched for $(100 \pm 10) \mu s$ for the microcomputer to read the information.

Self diagnostics with fault output

The DM7 is provided with an internal self check circuit that continuously monitors if the microprocessor is not in reset, input 120 VAC power, DC power supplies, resolver cable and output enable circuit. In case a fault occurs in any one of the above critical functions, the unit goes into fault mode and a transistor output changes state from ON to OFF. For failsafe operation, the fault output is ON for normal operation and turns OFF when a fault occurs. During the fault mode all outputs are disabled automatically.

Highly noise immune circuitry

Ratiometric tracking converter technique employed for resolver to digital decoding provides the best protection against electrical noise generated by power line transients and varying ground potentials. This decoding method is inherently immune to temperature changes and line frequency variations. The optical isolation adds an additional layer of protection against electrical noise and enhances the environmental integrity of the system.

Built in tachometer & Motion detector

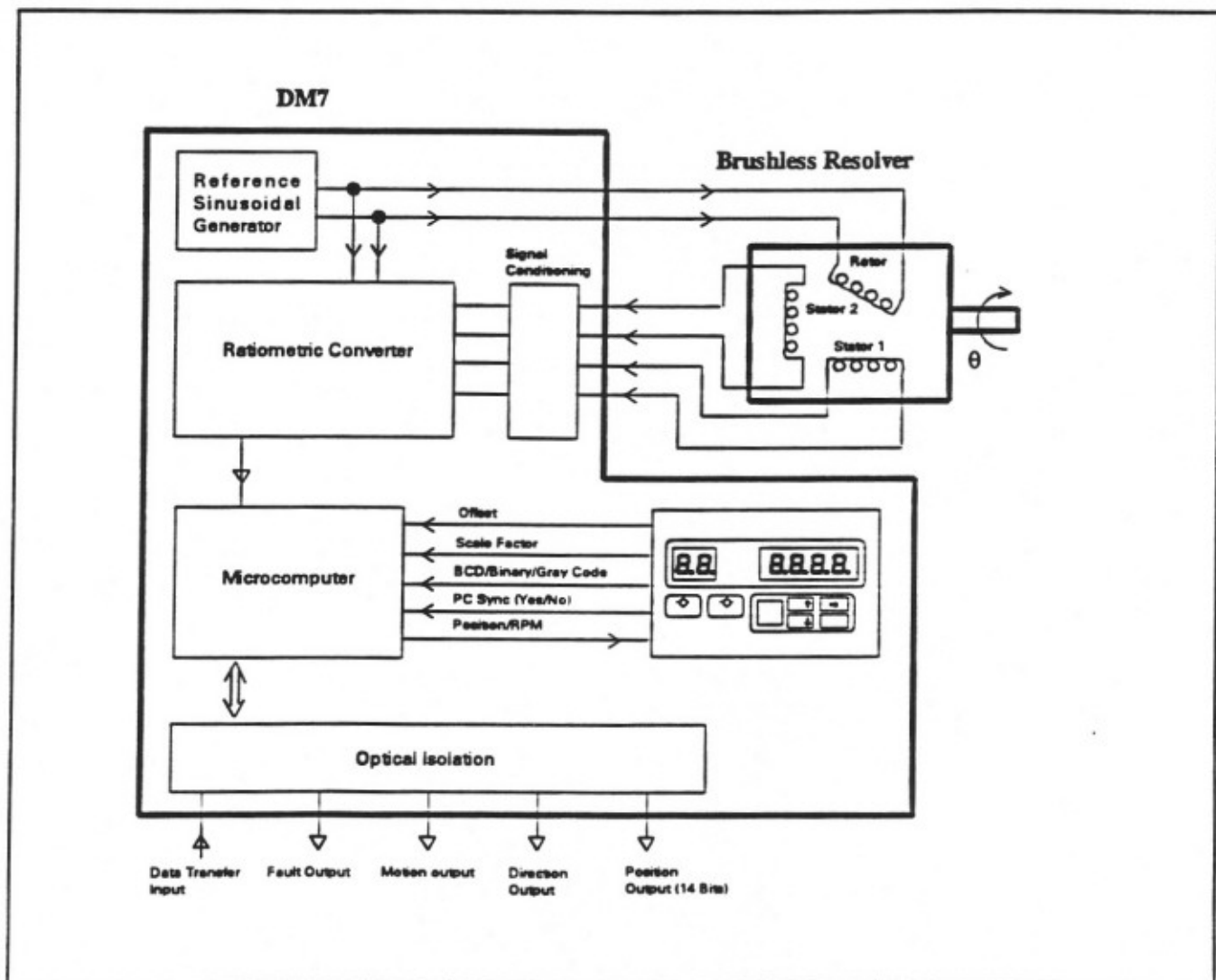
The shaft RPM is continuously displayed on the front panel. A front panel settable motion detector output is provided.

Program security

A supervisory input is needed to make any changes to the program to protect against unauthorized tampering.

Rugged and reliable resolver as position transducer

The DM7 series of resolver decoder combines the ruggedness of a resolver and reliability of an advanced solid state control. The rugged heavy duty NEMA 13 IP54 resolver can be mounted on a machine in any hostile industrial environments such as mechanical shock vibrations, extreme humidity and temperature changes, oil mist, coolants, solvents etc. and the resolver to digital decoder can be mounted up to 2500 feet away in a control panel.



Specifications

Input Power:

AC: 105 to 135 VAC, 7 VA; Optional 220, 240 VAC
DC: 11 to 28 VDC, 100mA (typical) exclusive of load

Operating Temperature

-10 °F to 130°F (-23°C to 55°C)

Position Transducer:

Autotech's series RL100, E6R, E7R, E8R or RL101 resolvers

Signal Resolution: 16384 counts/turn

Scale Factor: 19 to 16383, programmable

Output Update rate: 350 µsec

Programmable Offset: Full revolution

Decimal Point: Programmable after any digit

Resolver Cable length: 2500 Ft. (max) shielded

Outputs: (All outputs have to be same type)

Type of Outputs:

Caution: In the PC synchronization mode, all outputs are updated by the data transfer input strobe. This includes Fault output

Output Interface: T, P, N or C

T: LS TTL (74LS645)

Logic True: 2VDC @15mA,

20µA leakage when tristated;

Logic false: 0.35V @ 24mA,

0.4mA leakage when tristated

Mux Input: Low active TTL level

Logic True: 0 to 0.8 V; **Logic False:** 2 - 5V

P: PNP source transistor;

Logic True: Transistor ON, 1.7V drop @100 mA;

Logic False: Transistor OFF, 0.2 mA leakage @ 50V

N: NPN sink transistor;

Logic True: Transistor ON, 1.1V max @100 mA;

Logic False: Transistor OFF, 0.1 mA leakage @ 50V

C: NPN sink transistor;

Logic True: Transistor OFF, 0.1 mA leakage @ 50V

Logic False: Transistor ON, 1.1V max @100 mA;

Position Output Format:

Front panel selectable BCD, Gray code, Binary

Motion Output:

Logic true above high setpoint or below low setpoint

Direction Output: Logic true for increasing position

Fault Output: Logic false for fault (fail safe)

Output Isolation:

All outputs optically isolated upto 2500 Volts

Inputs :

Program Enable Input:

Enable : 0.8 V max @ 5 mA

Disable : 4V to 28 VDC

Output Enable Input:

Enable : 0.8 V max @ 5 mA

Disable : 4V to 28 VDC

Data Transfer Input:

0 to 24 VDC logic; Edge triggered (i.e. data transfer on both rising and falling edges)

Low Level : 0 to 0.8V @ 3.2 mA

High Level : 2.4V @ 0.4 mA

Minimum pulse width: 30 µs

Timing: Depends upon the PC sync option selected from keyboard :

PC Synchronization mode:

Updates position output within 150 µs of a transition edge (low to high, or high to low) at data transfer input

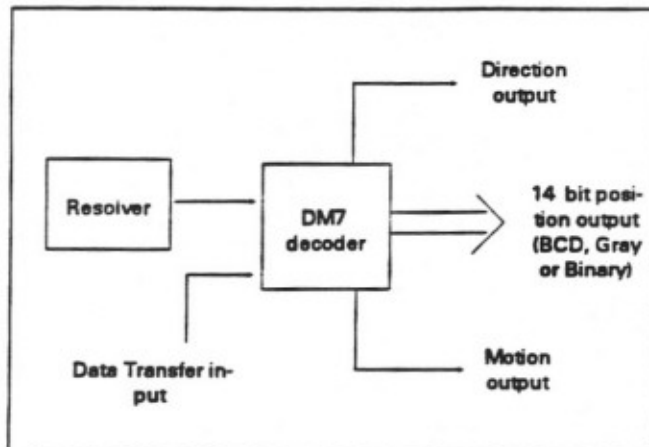
Transparent Mode /Microfreeze:

Output data is continuously updated at full speed. The data is latched for $100 \pm 10\%$ µs within 10 µs of a transition (high to low or low to high) at data transfer input

Installation and Operation

1. Introduction

A functional block diagram of Autotech's Programmable resolver decoder model DM7 is shown below:



As shown, the DM7-14Bit accepts an input from a single turn resolver E9R-RL102-000SE and decodes it to give a scaled 14 bit digital position signal, giving a resolution of 16384 counts per turn. The decoded resolver position information is displayed on the front panel of the unit, as well as is available on a 25 pin sub D connector. The format of position output is front panel key board selectable as BCD, Gray code or natural binary format.

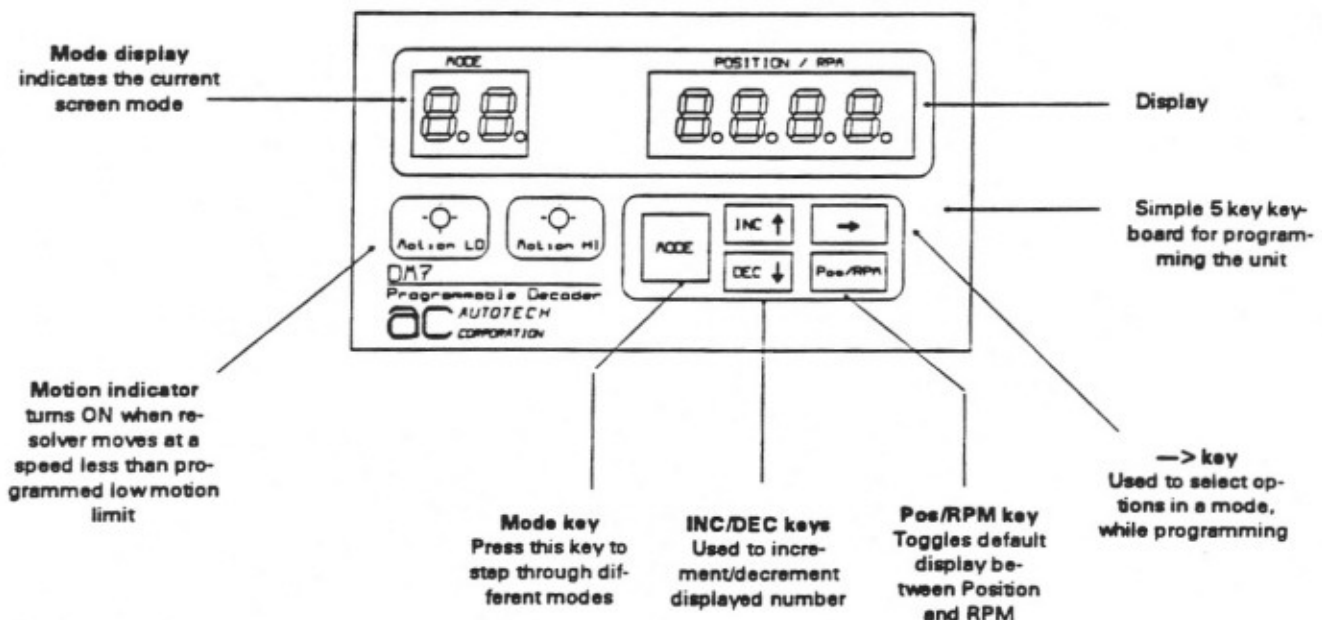
The DM7 also provides a direction and motion output. The high and low limits of the motion are programmable. The overspeed output is true when resolver speed is more than the programmed high limit, and underspeed output is true when the resolver speed is below the programmed low motion limit. The direction output is energized when the position is increasing.

The scale factor (desired counts per turn minus one) is programmable from 19 to 16383 to match the display and position to any output desired units in this range. For example, a scale factor of 359 may be selected to display resolver position in degrees, and a scale factor of 3599 will display the position in tenths of a degree. A static offset value may be programmed in the unit to electronically align resolver zero with machine zero.

The DM7 supports PC handshake for reliable data transfer from DM7 to external devices such as P.L.C. or computers.

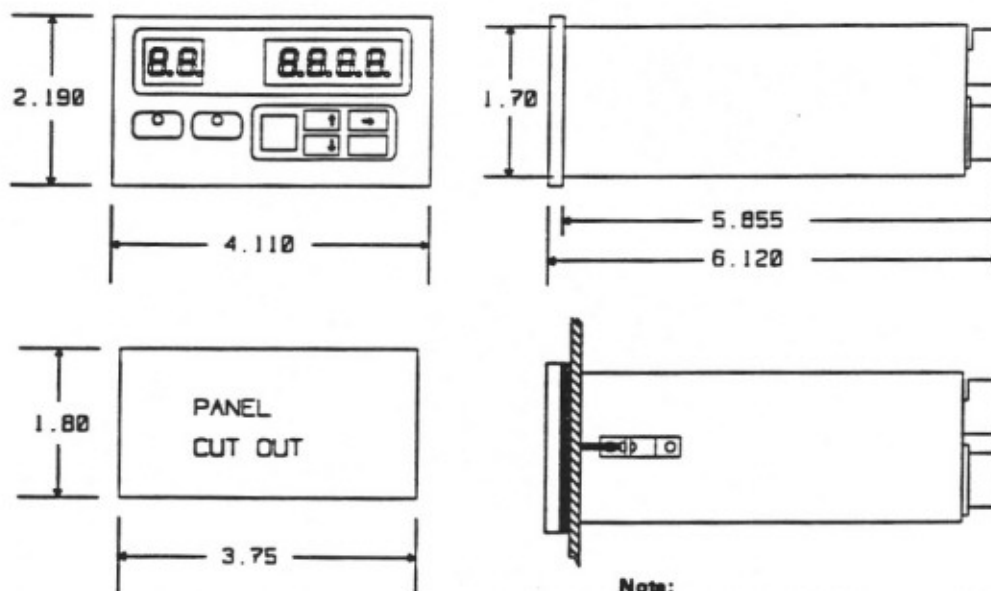
The unit may be ordered with TTL, P-, N- or C-type of outputs. It is packaged in a 1/8 DIN size enclosure, and has a NEMA 12 rating.

2. Front Panel



3. Mounting dimensions

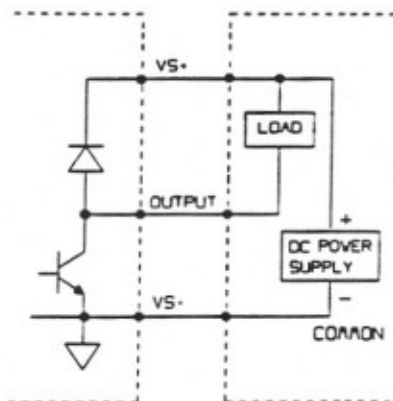
Figure below gives mounting dimensions of the DM7. The unit is housed in an 1/8 DIN panel mount case, and requires a rectangular panel cutout only (no mounting screw holes are required). Slide the unit in through the panel opening with gasket, insert the two right-angle mounting brackets into the openings on either side of the DM7 housing and slide brackets 1/4" towards the back of the unit to secure the brackets to the housing. Tighten the pair of screws on the right-angle brackets to hold the unit into the panel. **DO NOT OVER-TIGHTEN (80 inch-oz torque max) !**



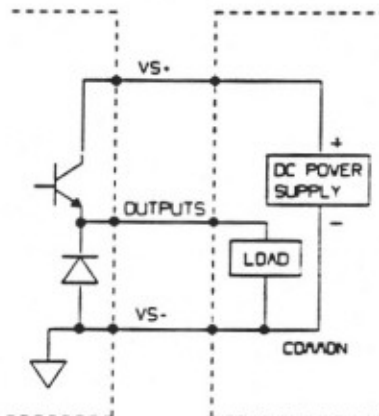
Note:
Allow a minimum of 2.75 inches for DB connector

4. Typical Output Configurations

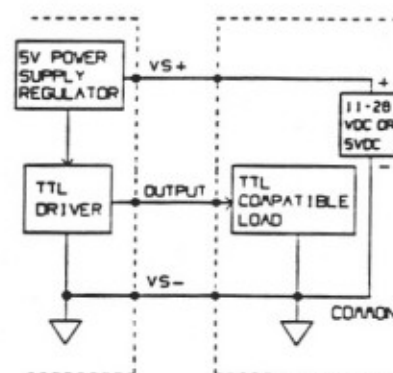
N and C types of outputs



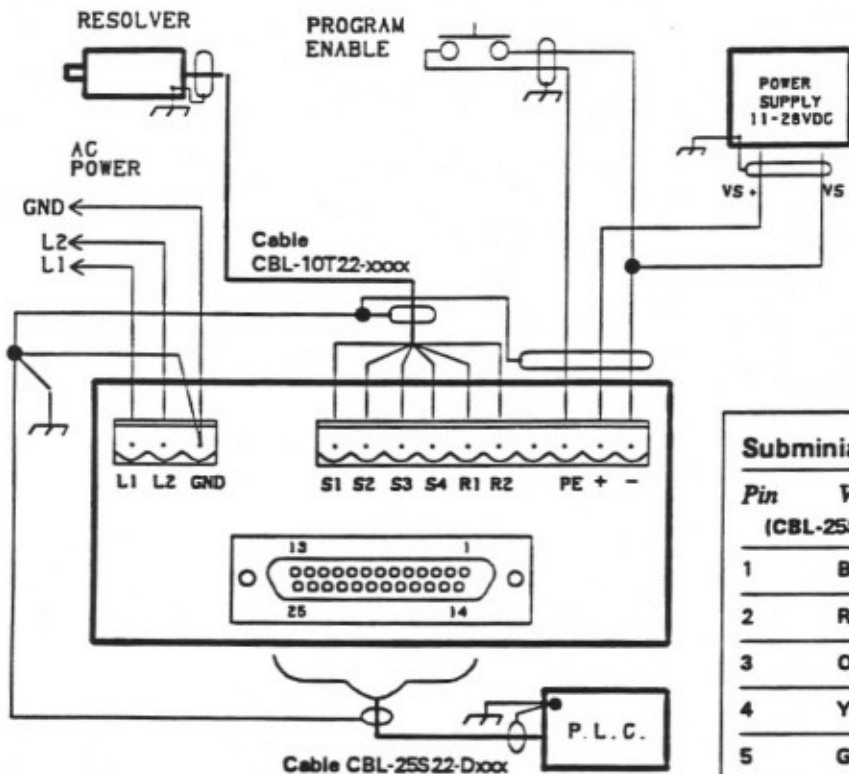
P type of outputs



TTL type of outputs



5. Rear View and Wiring Diagram



Indicates good metallic connection to earth ground plane on which each unit is mounted with shortest possible wire length of 14 gauge or less

Notes on grounding and shielding:

(Failure to observe any of these requirements may cause unpredictable operation and will void warranty)

1. All logic level wiring (including resolver and external power supply) must be done using overall foil shielded cables, with shields and equipment grounded as per above drawing. See How to Order section for suitable cables offered by Autotech.
2. Resolver shielded cable must consist of twisted pairs, and the twisted pairs must be wired as per wiring instructions. See How to Order section for a suitable resolver cable offered by Autotech.
It is recommended that the resolver shielded cable be run in its own separate conduit.
3. All ground planes on which the DM7 and all external equipment are mounted must be held to the same RF potential, by good metallic connections to building frames, conduit or wiring trays.
4. All shielded cable must be kept at a minimum distance of 2 inches from all high voltage or inductive wiring.
5. All shielded cable must be kept at a minimum distance of 12 inches from all motor wiring controlled by AC or DC drives.

CBL-10T22-xxxx Cable

Wire Color	Resolver terminal	
Green-Black	R1	Twisted pair
Green	R2	
Yellow-Black	S1	Twisted pair
Yellow	S3	
Blue-Black	S2	Twisted pair
Blue	S4	

Subminiature-D Pin Definitions

Pin	Wire Color (CBL-25S22-Dxxx)	Function/Bit values with		
		BCD	Binary	Gray Code
1	Brown	Output enable/Mux TTL		
2	Red	Do not use		
3	Orange	Fault output (Energized if unit is O.K.)		
4	Yellow	4000	NC	NC
5	Green	1000	B12	G12
6	Blue	400	B10	G10
7	Purple	100	B8	G8
8	Grey	40	B6	G6
9	White	10	B4	G4
10	Black	4	B2	G2
11	White/Brown	1	B0(LSB)	G0(LSB)
12	Black (12 ga)	VS— (Common)		
13	White/Orange	Data Transfer input		
14	White/Yellow	Motion		
15	White/Green	10000	NC	NC
16	White/Blue	Direction Output		
17	White/Purple	2000	B13(MSB)	G13(MSB)
18	White/Grey	800	B11	G11
19	White/Black/Grey	200	B9	G9
20	White/Black	80	B7	G7
21	White/Black/Brown	20	B5	G5
22	White/Black/Red	8	B3	G3
23	White/Black/Orange	2	B1	G1
24	White (12 Ga)	VS + (+11 to +28 VDC)		
25	White/Black/Yel	8000	NC	NC

6. Programming

Programming the DM7 requires entering of following values/options for the unit:

- **Scale Factor:** desired counts per revolution minus one
- **Offset:** constant to be added to the true resolver position, used to align machine zero with resolver zero.
- **Motion detector limits:** The output is energized when resolver turns at a speed less than the programmed low setpoint or greater than the programmed high setpoint.
- **Output type option:** BCD, Gray or Binary
- **PC synchronization option:** yes or no.

The five keys on the front panel are used in following manner:



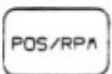
Used to step through different programming screen. The two 7-segment LEDs indicate the current screen or mode.



The INC/DEC keys are used to increase/decrease numerical entries, such as scale factor offset, etc.



Used to display and select options for output type and PC sync screens.



Used to toggle the default display between Position and RPM display. Pressing this key anytime returns display to Pos/RPM

Note:

The program enable input must be active (connected to VS—) to allow programming of the unit.

6.1 Default display:

The DM7 normally displays the position (true resolver position + offset), or RPM of the resolver. The display may be toggled between these two by pressing Pos/RPM key. The Pos/RPM key may be pressed to bring up the default display any time. Also, if there is no key pressed for one minute, the unit returns to its default display. The position display is as follows:

Po 1234

After a short time "Po" blanks out. The RPM display is as follows:

r 234

The INC, DEC keys are ignored in this mode

6.2 Scale Factor programming:

Press to display

Current scale factor is displayed

Use or to increase or decrease the displayed number until desired scale factor is displayed

Please note:

- Scale factor = desired counts per turn - 1
- Scale factor programming is inhibited when resolver is moving

6.3 Offset Programming

Press to display

Current offset is displayed


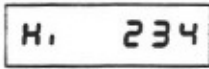
Use or to increase or decrease the displayed number until desired offset is displayed



Please note

- Default position display =
true resolver position + offset

Thus offset may be used to electronically align resolver to machine zero. The offset should be less than the scale factor.

6.4 Motion High Limit Programming:

Press  to display 
Current Motion High Limit is displayed



Use  or  to increase or decrease the displayed number until desired Motion High Limit is displayed

Please note:

- The Motion detector output is energized when resolver rotates at a speed greater than this limit

6.5 Motion Low Limit programming:

Press  to display 
Current Motion Low Limit is displayed


Use  or  to increase or decrease the displayed number until desired Motion Low Limit is displayed

Please note:

- The Motion detector output is true when resolver rotates at a speed lower than this limit

6.6 Decimal Point programming:


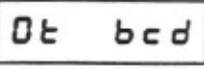
While displaying Pos/RPM, press


 to move decimal point to desired location.

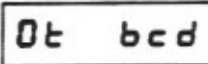
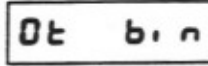
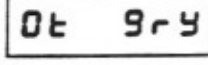
Please note that decimal point is arbitrary, and not used in any computation.


6.7 Output Type Selection:

Note: Selection is inhibited when resolver is moving

Press  to display 
i.e. "Ot" in left two digits, and right three digits will display the Current Output type programmed in the unit which may be bcd (for BCD), bin (for Binary), or gry (for Gray code)

Press  until desired option is displayed; the options are as followed:

	for BCD output format
	for Binary output format
	for Gray code output format


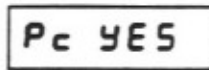
Press  to save the displayed output type, and to select PC synchronization option


6.8 PC synchronization option selection:

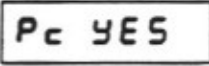
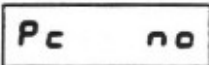
Note: Selection is inhibited when resolver is moving

Caution: In the PC synchronization mode, all outputs are updated by the data transfer input strobe. This includes Fault output

If not already displayed,


press  to display 
i.e. "Pc" in left two digits, and right three digits will display the Current PC synchronization option programmed in the unit, which may be yes or no.

Press  till desired option is displayed; the options are as followed:

	to enable PC synchronization
	to disable PC synchronization

PC synchronization: When enabled, the outputs are updated within 150 μ s of the data transfer input signal (rising or falling edge).

When disabled the outputs are updated continuously (but asynchronously) and are latched for 100 \pm 10 μ s after data transfer input edge

Press  to save the displayed option, and to return to Pos/RPM mode

How to Order

1. Programmable Resolver Decoder Model DM7

DM7-0 X X -010-14B: Basic unit resolver-to-digital decoder, programmable output format (gray code, BCD, binary) and resolution (20-16384 counts per turn)

1. Input Power:

- 1:** 117V AC, 60Hz
- 2:** 220V AC, 50Hz
- 4:** 240V AC, 50Hz

2. Type of Output:

- T:** TTL, 5 V logic with multiplexing
- P:** PNP source transistor, 100mA max @50V max, high true logic
- N:** NPN sink transistor, 100mA max @50V max, low true logic
- C:** NPN sink transistor, 100mA max @50V max, high true logic

1a. Slave Unit

DS7-0 X X -010-14B: Slave Unit for Model DM7 listed from "1" above.

2. Cable

CBL-25S22-Dxxx Cable for digital output wiring with overall foil shield and 25 pin sub "D" connector on one end
xxx = Standard Length in feet (10, 25, 50 and in increments of 50 feet)

ECM-25PIN-M11 25 pin sub "D" male connector (mates with the connector on DM7).

3. Position Transducer

DM7 requires Autotech's single turn resolver E9R-RL102-000SE as a position transducer.

E9R-RL102-000X X

Connector Position:

E: Back-end

S: Side

Mounting:

F: Flange Mount

S: Servo Mount

WARRANTY

Autotech Corporation warrants its products to be free from defects in materials or workmanship for a period of one year from the date of shipment, provided the products have been installed and used under proper conditions. The defective products must be returned to the factory freight prepaid and must be accompanied by a Return Material Authorization (RMA) number. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Autotech Controls harmless from, defend, and indemnify Autotech Controls against damages, claims, and expenses arising out of subsequent sales of Autotech Controls' products or products containing components manufactured by Autotech Controls and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or subcontractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (p.l. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The customer acknowledges the disclaimers and limitations contained and relies on no other warranties or affirmations.

CAUTION

Autotech Controls' products are carefully engineered and rigorously tested to provide many years of reliable operation. However any solid-state device may fail or malfunction sometime. The user must ensure that his system design has built-in redundancies if Autotech Controls' product is being used in applications where a failure or malfunction of the unit may directly threaten life or cause human injury. The system should be so designed that a single failure or malfunction does not create an unsafe condition. Regularly scheduled inspections, at least once a week, should be made to verify that the redundant circuits are fully functional. All faults should be immediately corrected by repair or replacement of the faulty unit. In addition, the user may have to comply with OSHA, ANSI, state or local standards of safety. The user of Autotech Controls' products assumes all risks of such use and indemnifies Autotech Controls against any damages.

The information in this book has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Autotech Controls reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Autotech Controls does not assume any liability arising out of application or use of any product described herein.

Autotech Controls does not recommend the use of its products in applications wherein a failure or malfunction of the unit may directly threaten life or cause human injury. The user of Autotech Controls' products assumes all risks of such use and indemnifies Autotech Controls against all damages.

© Copyright 1992 by Autotech Controls, Limited Partnership. All rights reserved.