



Automation



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# DMM Multi-Axis Multi-Turn Resolver Decoder

## Instruction & Operation Manual

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# Multi-Axis Multi-Turn Resolver Decoders

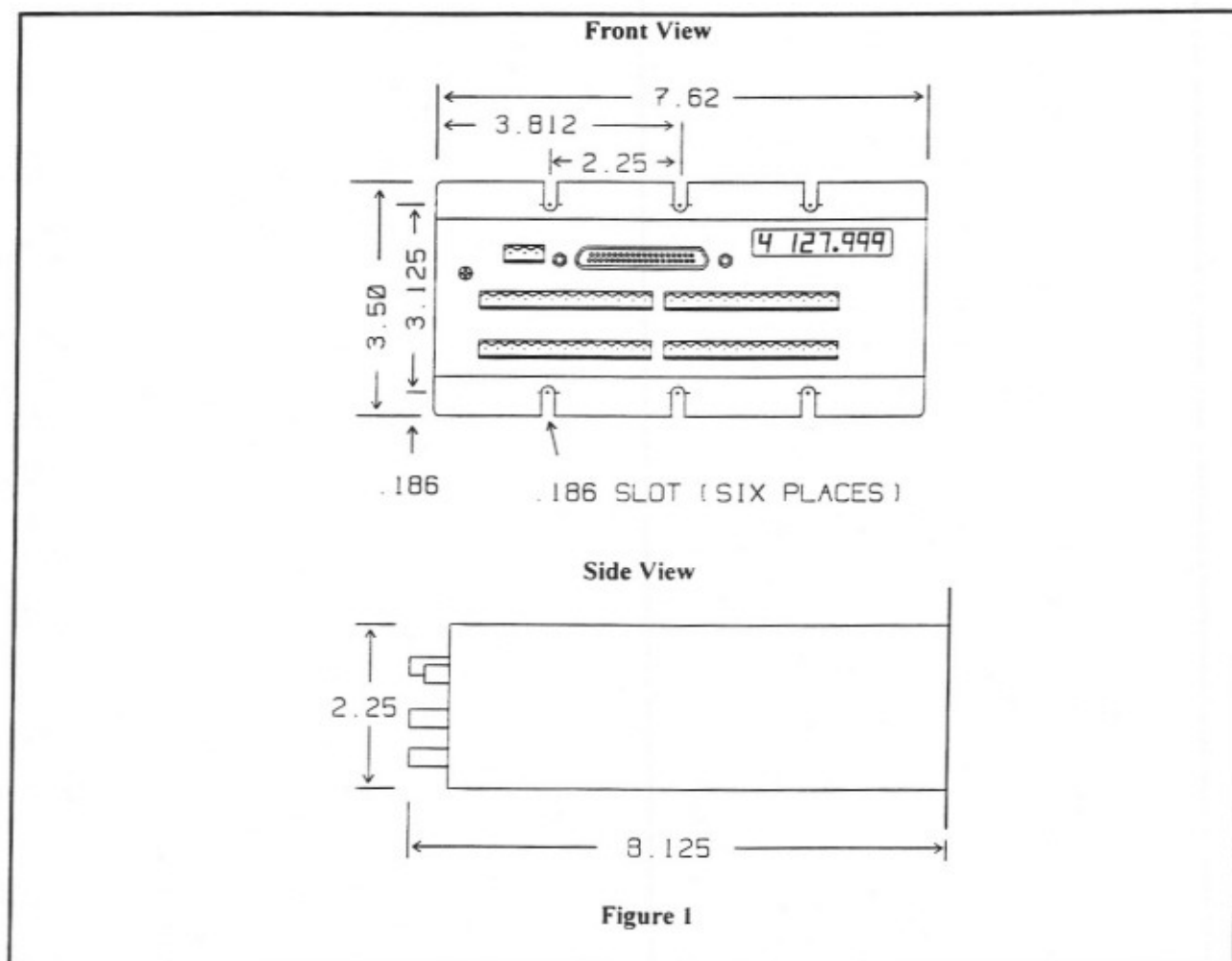
## Instruction Manual

### The DMM

#### Principle of Operation

The DMM decoders are available with either output or input multiplexing. The resolver analog signals are converted to the output digital format by a tracking resolver-to-digital converter. With input multiplexing, the analog signals are multiplexed to a single digital converter. In output multiplexing, multiple decoders are multiplexed to the parallel

digital output port. The binary code at the input selects a particular resolver for output, as well as the gear ratio for the selected resolver. Output multiplexing allows for a fast response and is recommended for high speed operations. In the input multiplexing versions, there is a 100 msec settling time after a change in resolver selection before the data is stable. The output multiplexing has only 15  $\mu$ sec settling time.



## Variety of Outputs, Built-in PC-Handshake Permit Interface to any PLC

BCD, natural Binary or Gray Code output formats are available with a choice of TTL, PNP source transistor or NPN sink transistor outputs. Optional PLC synchronization circuit provides an error-free method of interfacing output position data from the decoder to any programmable controller. Upon receipt of a data transfer command from the PLC, the stable data is latched and made available to the PLC.

## Multiplexing Capability

The TTL type of outputs have multiplexing capability, which allows more than one decoder to be connected to the same control unit for multi-axis applications. For multiplexing PNP or NPN type outputs, consult the factory.

## Up to 1024 Counts Per Turn Resolution at 1800 RPM

The DMM series resolver decoders are available with resolutions of 1000 or 1024 counts per turn to match many control needs. The high performance ratiometric tracking converter assures exacting performance at speed up to 1800 RPM.

## Selectable Resolver Gear Ratios

All DMM series resolver decoders are equipped with a standard user selectable resolver gear ratio feature. This allows resolvers with differing gear ratios to be connected to a sin-

gle DMM, providing maximum machine application flexibility. Resolver gear ratios supported by the DMM include 16:1, 32:1, 64:1 and 128:1.

## Highly Noise Immune Circuitry

The ratiometric tracking converter technique employed for resolver to digital decoding provides the best protection against electrical noise generated by power line transients, radio frequency interference and varying ground potentials. The ratiometric converter is practically immune to temperature variations and line frequency changes.

Optional optical isolation adds another layer of protection and enhances system integrity.

## Extremely Rugged and Reliable Resolver as Position Transducer

The DMM series of resolver decoders 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 shaft in any hostile industrial environment, such as mechanical shock, vibrations, extreme humidity and temperature changes, oil mists, coolants, solvents, etc. The DMM decoder can be mounted up to 2500 feet from the resolver in a control panel.

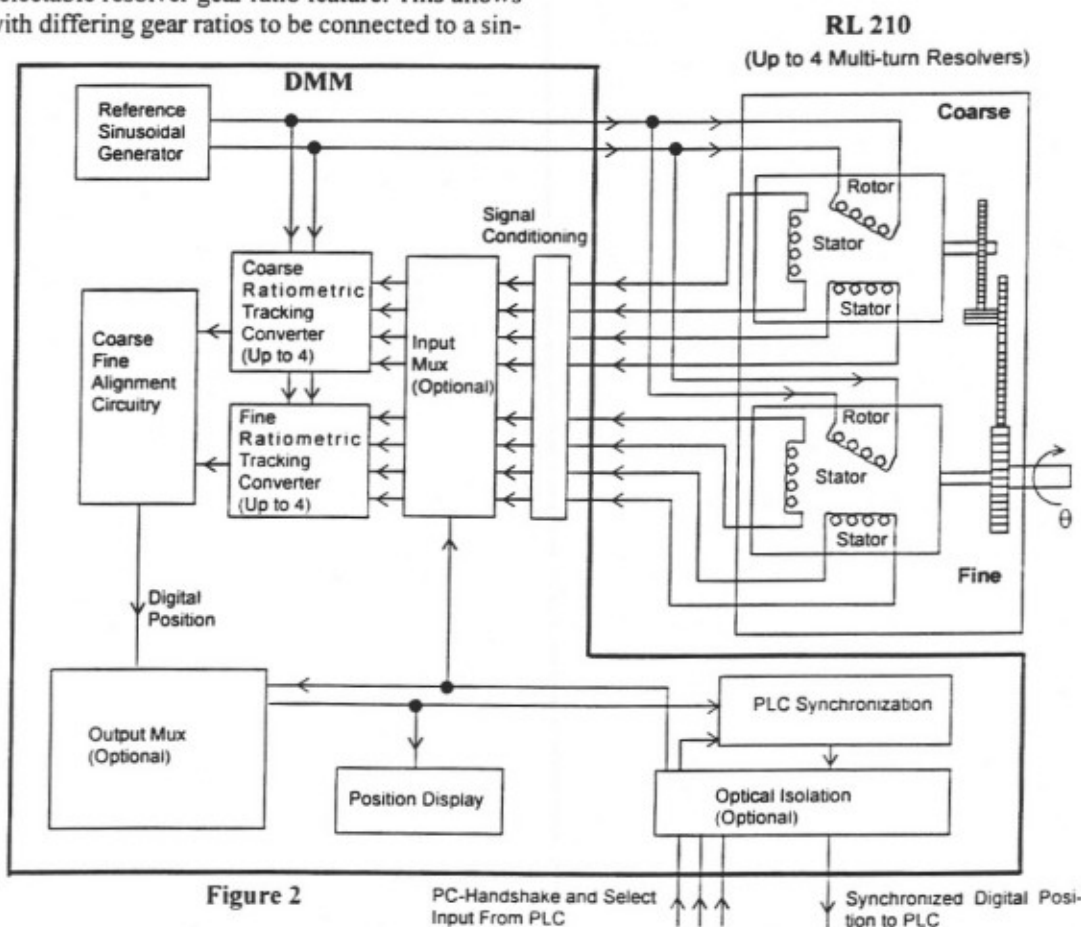


Figure 2

# Specifications

## Input Power

AC Power: 105–135 V or 210–270 V, 50/60 Hz, 5 W  
DC Power: 8–30 VDC @ 0.25 A exclusive of load (without opto use, an external power supply is needed only for 'P' outputs)

Operating Temperature: –10 to +130 °F (–23 to +55 °C)

## Position Transducer:

Autotech's RL210-G64 or RL210-G128 multi-turn resolvers.

## Output Format and Resolution:

BCD: 1000 counts per turn  
Natural Binary: 1000 or 1024, counts per turn  
Gray code: 1000 or 1024 counts per turn

## Maximum Cable Length between Resolver and DMM:

2500 feet shielded (twisted pair)

Resolver shaft speed: 3600 RPM (Max)

Resolver to digital decoder tracking speed: 1800 RPM

## Display:

6 digits for position, 1 digit for channel, all are 0.25" 7 segment LEDs

## P.L.C. Sync Input: (optional)

Positive edge (Low to High) and Negative edge (High to Low) triggered.  
(See Input Logic for Voltage and Current specifications)

PC Handshake strobe: 30 µsec minimum width.

Strobe Delay to Latch Data: 100 µsec.

## Transparent Mode /Microfreeze (Standard):

Output data is continuously updated at full speed. The data is latched for 100 / 10 µsec within 30 µsec of a transition (High to Low or Low to High) at data transfer input.

## Optical Isolation (Optional):

2500 Volts, on all I/O's except resolver

## Input Logic (Channel Select, P.L.C. Sync, Gear Select):

### 28VDC Max:

P type: Logic False, 0 to 0.8V @ 0.4 mA;  
Logic True, 2.4V @ 3.2mA

N type: Logic False, 3.8V @ 0.4mA;  
Logic True, 0 to 0.8V @ 3.2mA

C type: Logic False, 0 to 0.8V @ 3.2mA;  
Logic True, 3.8V @ 0.4mA

### 0 to 5VDC Logic:

T type: Logic False, 0 to 0.8V @ 3.2mA;  
Logic True, 2.4V @ 0.4mA

## Channel Select Timing:

Input Multiplexing: 100 msec from channel select.

Output Multiplexing: 15 µsec from channel select.

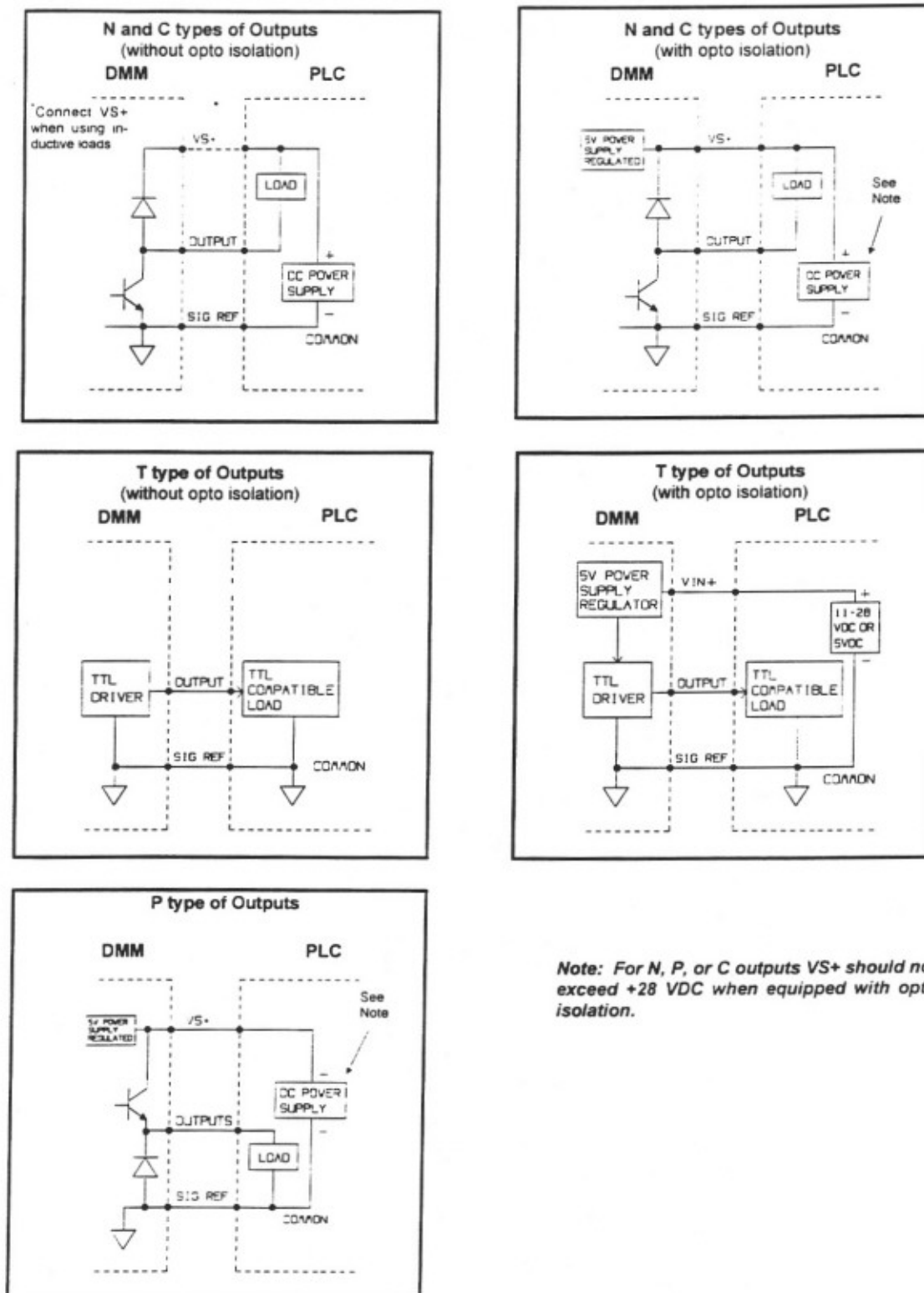
## Gear Ratio Select Timing:

15 µsec from gear ratio select input.

Output Type	T: TTL* (74HC245)	P: PNP Source Transistor (Sprague UDN-2981A)	N: NPN Sink Transistor Low True (Sprague ULN-2803A)	C: NPN Sink Transistor High True (Sprague ULN-2803A)
Logic True	2 VDC @ 15 mA; 2.4 V @ 3 mA (20 µA leakage when Tristated)	Transistor ON 1.7 V drop @ 100 mA	Transistor ON 1.1 V @ 100 mA	Collector Open 0.1 mA leakage @ 50 VDC
Logic False	0.35 V @ 24 mA (0.4 mA leakage when Tristated)	Transistor OFF 0.2 mA leakage @ 50 V	Collector Open 0.1 mA leakage @ 50 VDC	Transistor ON 1.1 V @ 100 mA

\*Note: Multiplexing or Tristating Input = Low active TTL level (i.e., Logic True: 0–0.8 V; Logic False: 2–5 VDC)

## Typical Output Configurations



**Note:** For N, P, or C outputs VS+ should not exceed +28 VDC when equipped with opto isolation.

Figure 3

# Installation and Operation

## 1. Position Transducer Mounting and Wiring

Refer to the installation and wiring instructions for the transducer used in your application.

## 2. Decoder Mounting and Wiring

### 2.1 Mounting

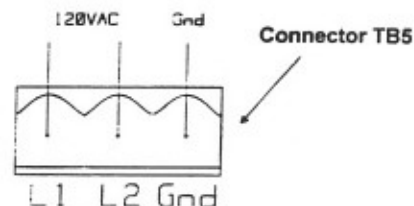
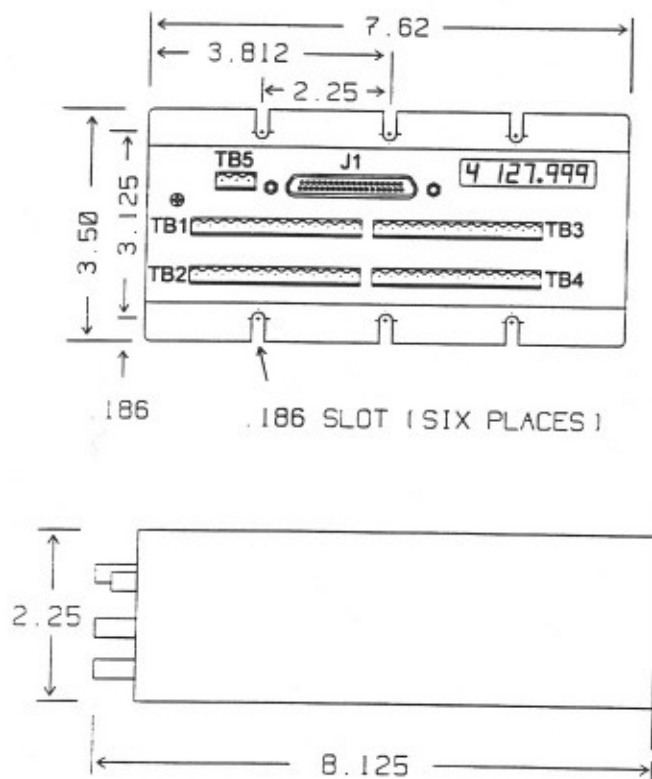
The DMM is designed to be mounted on a panel using the dimensions provided in this manual. In choosing the location, allow adequate wiring space in front of the DMM to eliminate mechanical stresses to cables and connectors. Also maintain cabinet internal temperature to be within DMM specifications.

### 2.2 Wiring:

Wiring should always be done with system power removed. Wiring should be inspected for proper connections, absence of wire strands, and mechanical integrity of the terminal screws. All logic wiring, resolver connections, digital outputs and customer power ( $V_s$  +/-) must use shielded cable. Adequate separation must be maintained between the above cables and high voltage, high current, or any inductive wiring. Refer to the drawing on grounding and shielding requirements.

#### 2.2.1 External Power and Resolver Connections:

Connect the 120VAC power input to L1 and L2 and earth ground to the 3-Pin Weidmuller connector TB5. See diagram and table below:

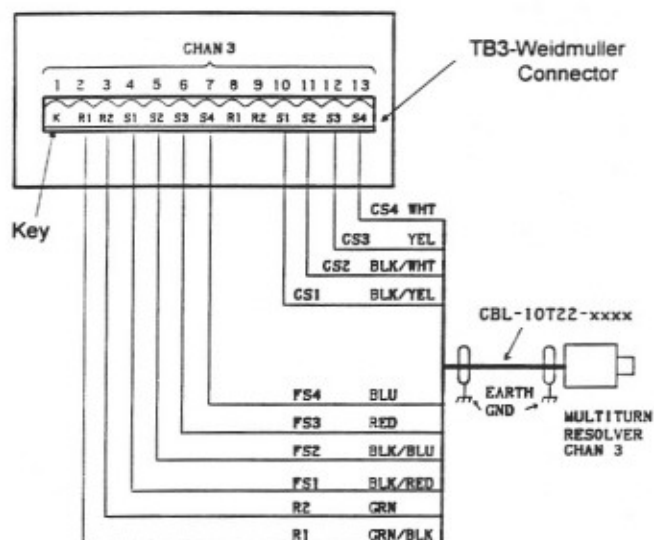


TB5 Connections		
Pin #	Terminal Name	Function
1	L1	AC Power
2	L2	AC Power
3	GND	AC Gnd

Figure 4

Connect the six wires from the resolver to the corresponding input channel number of Wiedmuller connectors TB1 through TB4. These terminals do not require lugs. See diagram and tables shown below:

*Typical Wiring Diagram for Resolver Connections  
(Connector TB3 shown)*



**Figure 5**

## 2.2.2 Shielding and Grounding

(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 figures 5 and 7. 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 DMM 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 load 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.

PIN #	WIRE (RES #)
1	R1 (1 FIN)
2	R2 (1 FIN)
3	S1 (1 FIN)
4	S2 (1 FIN)
5	S3 (1 FIN)
6	S4 (1 FIN)
7	R1 (1 CRS)
8	R2 (1 CRS)
9	S1 (1 CRS)
10	S2 (1 CRS)
11	S3 (1 CRS)
12	S4 (1 CRS)
13	KEY

PIN #	WIRE (RES #)
1	R1 (2 FIN)
2	R2 (2 FIN)
3	S1 (2 FIN)
4	S2 (2 FIN)
5	S3 (2 FIN)
6	S4 (2 FIN)
7	KEY
8	R1 (2 CRS)
9	R2 (2 CRS)
10	S1 (2 CRS)
11	S2 (2 CRS)
12	S3 (2 CRS)
13	S4 (2 CRS)

PIN #	WIRE (RES #)
1	KEY
2	R1 (3 FIN)
3	R2 (3 FIN)
4	S1 (3 FIN)
5	S2 (3 FIN)
6	S3 (3 FIN)
7	S4 (3 FIN)
8	R1 (3 CRS)
9	R2 (3 CRS)
10	S1 (3 CRS)
11	S2 (3 CRS)
12	S3 (3 CRS)
13	S4 (3 CRS)

PIN #	WIRE (RES #)
1	R1 (4 FIN)
2	R2 (4 FIN)
3	KEY
4	S1 (4 FIN)
5	S2 (4 FIN)
6	S3 (4 FIN)
7	S4 (4 FIN)
8	R1 (4 CRS)
9	R2 (4 CRS)
10	S1 (4 CRS)
11	S2 (4 CRS)
12	S3 (4 CRS)
13	S4 (4 CRS)

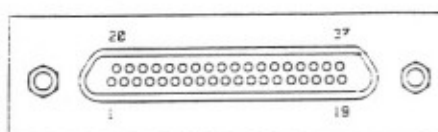


### 2.2.3. Digital I/O Wiring:

Please see the wiring chart and connector diagram on this page.

The digital I/O wiring should use shielded cable like Autotech's CBL-37S22-DCxxx. The shield is unterminated at the connector end and should be connected to "signal common" at the programmable logic controller (PLC). "Signal

**Connector J1**



Connector for logic input/output on front panel of DMS Series Decoder

**Figure 6**

**DMM Series Decoder Wiring Table (for Connector J1)**

See Note 1 Pin #	See Note 2 Color	Signal Description	BCD Function	Binary Function	Gray Code Function
1	Green Black	Sig Gnd (Customer VCC-)			
2	Red	Chan Select 0			
3	Orange	N/C			
4	Orange Black	Gear Select 1			
5	Green	N/C			
6	Blue	N/C			
7	Blue Black	Data Transfer (handshake)			
8	Black White		1 bit	N/C	N/C
9	White		4 bit	N/C	N/C
10	Black		10 bit	bit 0	bit 0
11	Red White		40 bit	bit 2	bit 2
12	Green White		100 bit	bit 4	bit 4
13	Red Green		400 bit	bit 5	bit 5
14	Blue White		1000 bit	bit 8	bit 8
15	Red Black		4000 bit	bit 10	bit 10
16	White Black		10000 bit	bit 12	bit 12
17	White Red		40000 bit	bit 14	bit 14
18	Black Red		100000 bit	bit 15	bit 15
19	Orange Red	N/C			
20	Blue Red	Customer VCC+			
21	Orange Green	Chan Select 1			
22	Black White Red	Gear Select 0			
23	Red Black White	N/C			
24	Green Black White	N/C			
25	White Black Red	Tristate (T)			
26	Orange Black White	N/C			
27	Blue Black White		2 bit	N/C	N/C
28	Black Red Green		8 bit	N/C	N/C
29	White Red Green		20 bit	bit 1	bit 1
30	Red Black Green		80 bit	bit 3	bit 3
31	Green Black Orange		200 bit	bit 5	bit 5
32	Orange Black Green		800 bit	bit 7	bit 7
33	Orange White Blue		2000 bit	bit 9	bit 9
34	Blue White Orange		8000 bit	bit 11	bit 11
35	Black White Orange		20000 bit	bit 13	bit 13
36	White Red Orange		80000 bit	bit 15	bit 15
37	White Red Blue	N/C			

Note 1: Pin numbers apply to mating connector #ECM-37PIN-M11

Note 2: Wire colors and pin numbers apply to mating cable assembly #CBL-37S22-DCxxx

See How to Order, section 3, to specify these accessories.



common" at the PLC end should have a minimum of 100K ohm resistance to chassis ground. If "signal common" must be tied to earth ground, the DMS should be ordered with the optical isolation option. The DMS decoder can be mounted up to 200 feet away from the PLC using the recommended cable. For output and input interface to PLC or other external devices see input/output Interface Section in this catalog.

#### Notes:

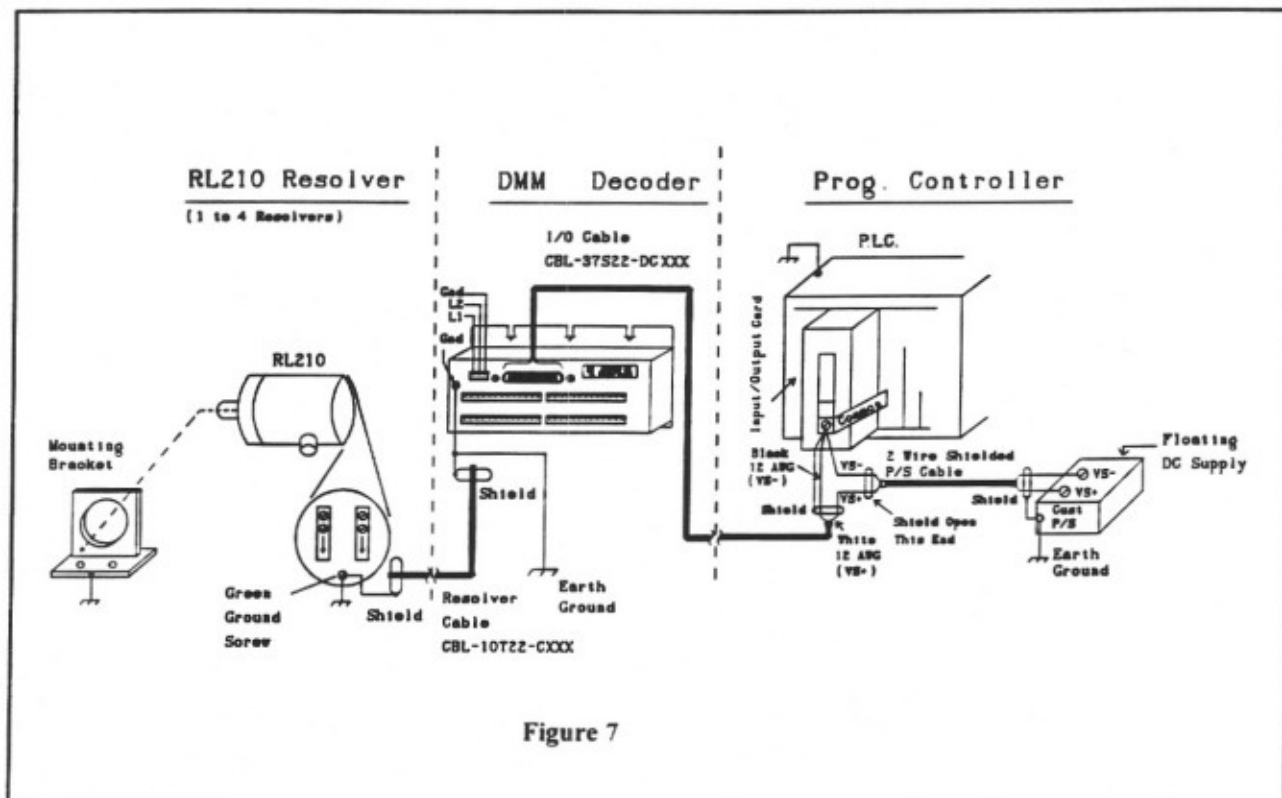
1. When power is applied to the decoder the outputs go to a power-on code state for approx. 130 msecs. For N Outputs: The output lines are all 1's for 130 msecs.
2. The customer system design should take into account the power up state of the decoder.

## 3. Operation

### 3.1 PC Handshake:

The PC handshake circuitry allows synchronization of the continuously changing resolver information to the PLC, eliminating the possibility of capturing this resolver data at a transition. This is accomplished by latching this resolver data at a known time after receiving a strobe from the PLC unit. This data remains latched until the completion of the next strobe and data transfer delay. The PC-handshake is triggered by either a low-to-high or high-to-low transition of the Data Transfer input and is non re-triggerable during delay time. The transfer delay time from the PC handshake transition to a valid resolver position data output is set to 100  $\mu$ sec.

There are no field adjustments in the DMS.



### 3.2 Resolver Channel Select

The DMM series decoders are multi-axis decoders. Depending upon the configuration, each DMM unit can decode the position of up to 4 multi-turn turn resolvers. Each resolver is connected to a separate input channel (1-4) on the DMM decoder via the front panel Weidmuller connectors TB1-TB4. The DMM decoder will output decoded position data for only one channel at a time. The data is output via logic input/output connector J1. Which channel's data is output is determined by the logic levels present at connector J1's "Channel Select" input pins (pins 2 and 21). Refer to the following "Channel Select Table" for channel select coding.

Channel Select Table		
Channel #	CS 1	CS 0
1	F	F
2	F	T
3	T	F
4	T	T

**Note:**

**T** = "ON" or "Active" state

**F** = "OFF" or "Inactive" state

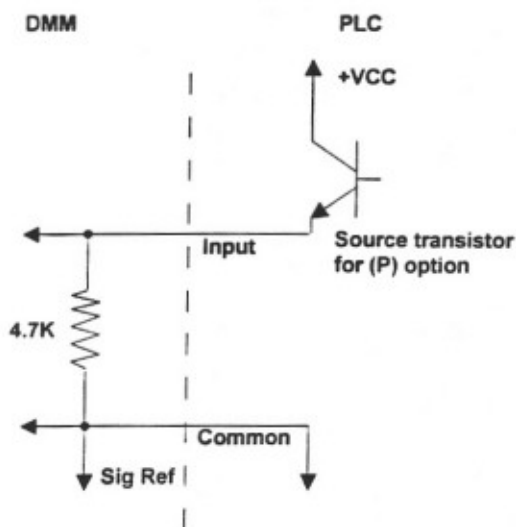
### 3.3 Gear Ratio Select

Each DMM decoder is capable of decoding the position of resolvers with differing gear ratios. Resolvers with gear ratios of 128:1, 64:1, 32:1, and 16:1 can be connected to the DMM channel inputs via TB1-TB4. When reading the position of a channel's resolver, the PLC or computer also selects a gear ratio input corresponding to the resolver's gear ratio. This selection is determined by the logic levels present at connector J1's "Gear Ratio Select" input pins (pins 4 and 22). Refer to the "Gear Ratio Select Table" below for gear ratio select coding.

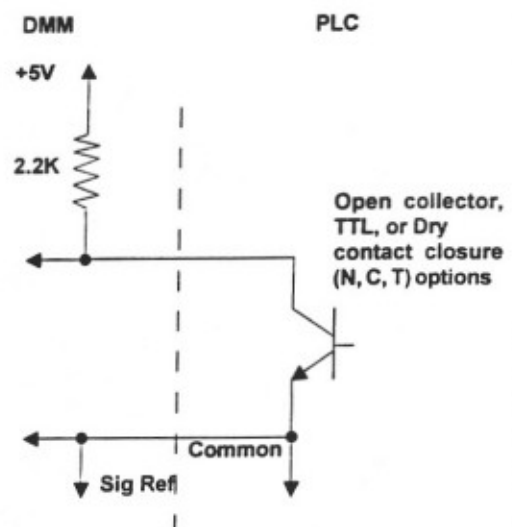
Gear Select Table		
Gear Ratio FIN : CRS	GS 1	GS 0
16 : 1	F	F
32 : 1	F	T
64 : 1	T	F
128 : 1	T	T

**Channel Select and Data Transfer Interface Diagram**

Configuration for "P" Option



Configuration for "N, C, T" Options



**Figure 8**

### 3.4 Microcomputer Synchronization (Microfreeze)

The standard "microfreeze" output-synchronization feature can be thought of as a "transparent PC Handshake". This feature is particularly useful when interfacing the DMS directly to a microcomputer where data transfer speeds are very fast.

When equipped with the microfreeze synchronization feature, the DMM will output decoded resolver position data continuously. When the microcomputer wants to read the resolver position data, it should toggle the DMM PC Handshake input. The PC Handshake input can toggle on either a high-to-low or low-to-high signal transition. Immediately after the PC Handshake input is toggled, the DMM will freeze (or hold) the current decoded resolver position output. The DMM will freeze this data for 100  $\mu$ sec ( $\pm 10\%$ ) to allow the microcomputer time to read the resolver position without the possibility of output data changing. After this period of time, the DMM will resume outputting resolver position data continuously.

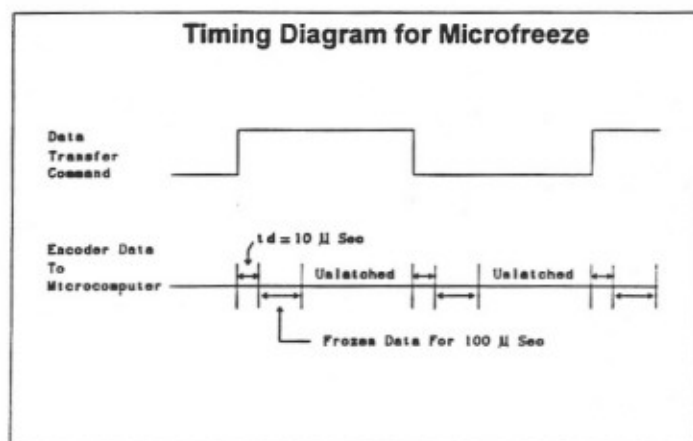
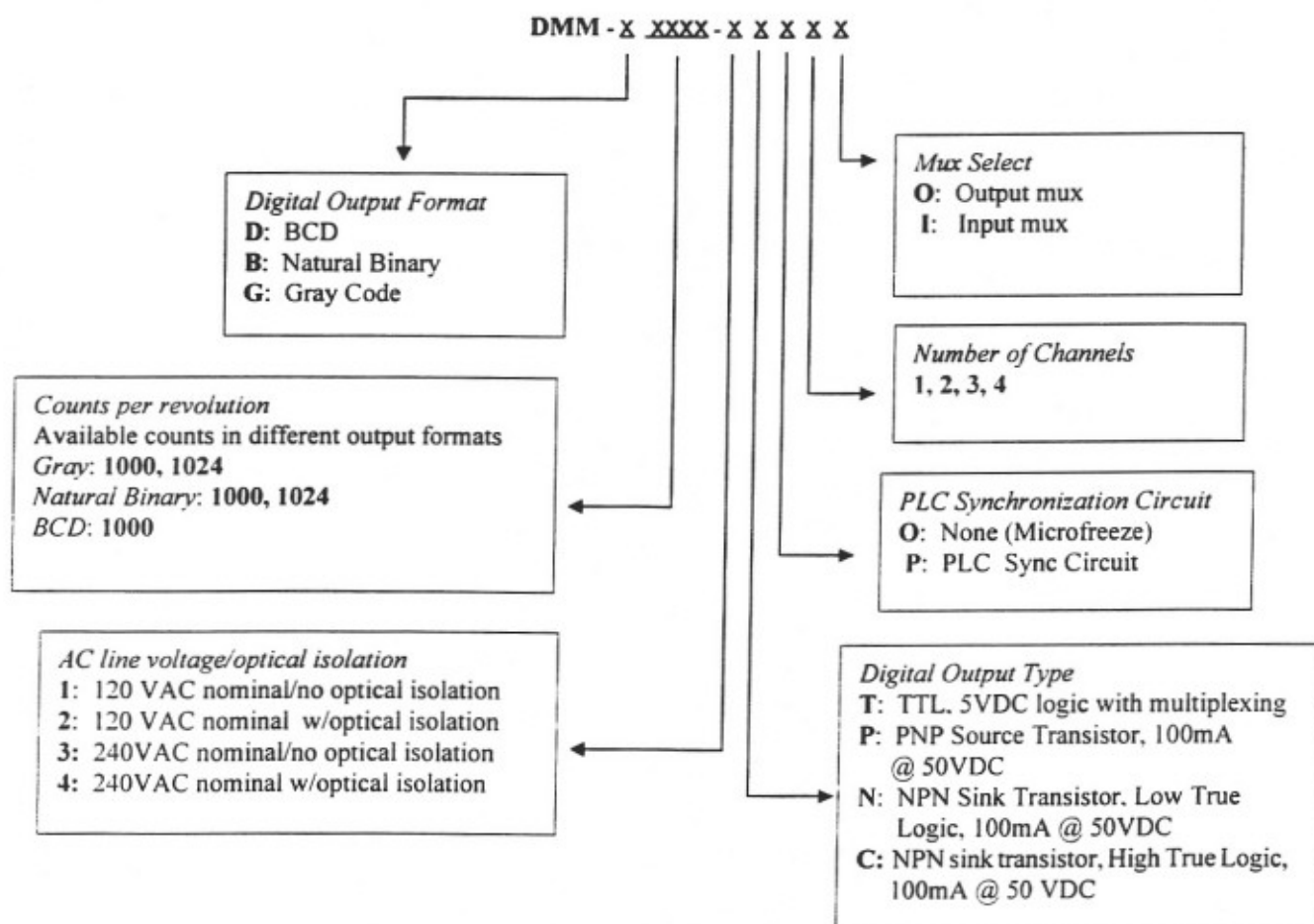


Figure 9

# How to Order

The decoding system consists of a resolver-decoder, a position transducer (resolver), and appropriate interconnecting cables.

## 1. Multi-axis Multi-turn Resolver Decoder



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## 2. Position Transducers

Select appropriate multi-turn turn resolver model RL210-G64 or RL210-G128. See position transducer section for How to Order Information.

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## 3. Accessories

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### *3.1 Output Cables from decoder to PLC or other devices*

CBL-37S22-DCxxx	37 conductor cable for digital output wiring with overall foil shield and 37 pin sub "D" connector on one end xxx = Standard length in feet (10, 25, 50 and in increments of 50 feet)
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ECM-37PIN-M11	37 pin sub "D" male connector (mates with the connector on DMS)
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### *3.2 Other Accessories*

For ordering resolver to decoder cable, mounting bracket, flexible shaft coupling, etc., see the Position Transducer Section.

## WARRANTY

Autotech Corporation and MC Technologies warrant their 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.

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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.

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