
Autotech Controls
ModBus Plus Multi-Turn Resolver
SAC-RL210-MBP
Instruction & Operation Manual



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Rotary Position Transducers

ModBus Plus Dual Resolver SAC-RL210-MBP

Instruction Manual

Resolvers

Rugged and Reliable

The resolver is a highly accurate and highly dependable device for absolute position shaft encoding. Resolvers have a reliable track record of applications in aerospace, military, and industry, where they have been used for decades for position sensing. Some of the common applications are radar antenna position sensing, missile guidance systems, NC machine position feedback, automotive stamping presses, 2 piece can-manufacturing presses and packaging machines. The resolver is designed to operate reliably under extremely hostile environments such as continuous mechanical shock, vibration, extreme temperature and humidity changes, oil mist, coolants and solvents.

The resolver is a passive transducer. It is a brushless rotary transformer with one rotor and two stator windings. The stator windings are electrically 90 degrees out of phase with each other. As the shaft rotates, the relative position of the rotor and the stator windings change. Either the rotor or the two stator windings together can be used as the primary of the rotary transformer and the secondary will then produce an analog voltage corresponding to the shaft position.

Dual Resolvers for Multi-Turn Application

A multi-turn resolver consists of two resolvers coupled to each other through a gear train. One of the resolvers, called the fine resolver, is coupled to the machine shaft in such a

way that it turns at the same RPM as the machine, while the other resolver, called the coarse resolver, is geared down by the gear ratio used. As the shaft of the multi-turn resolver turns with the machine movement, the coarse resolver keeps track of the number of revolutions and the fine resolver keeps track of the shaft position in each revolution. Thus the combination of the two resolver signals gives the absolute machine position. The gear train uses an anti-backlash gear to eliminate backlash errors.

SAC-RL210-MPB

The SAC-RL210-MBP Mod Bus Plus Multi-Turn Resolver provides shaft position information to the user's application via the ModBus Plus bus. There are two resolvers within the unit, geared 128:1. The two resolvers are connected to electronics implemented within the unit. Those circuits convert the resolver's outputs into a 17-bit position value. The most significant 7 bits indicate the turn number (0 to 127 turns). The least significant 10 bits indicate the position within the current turn (1024 counts/turn). That position data is made available to the subsystem within the resolver. The data can then be accessed by a ModBus Plus device.

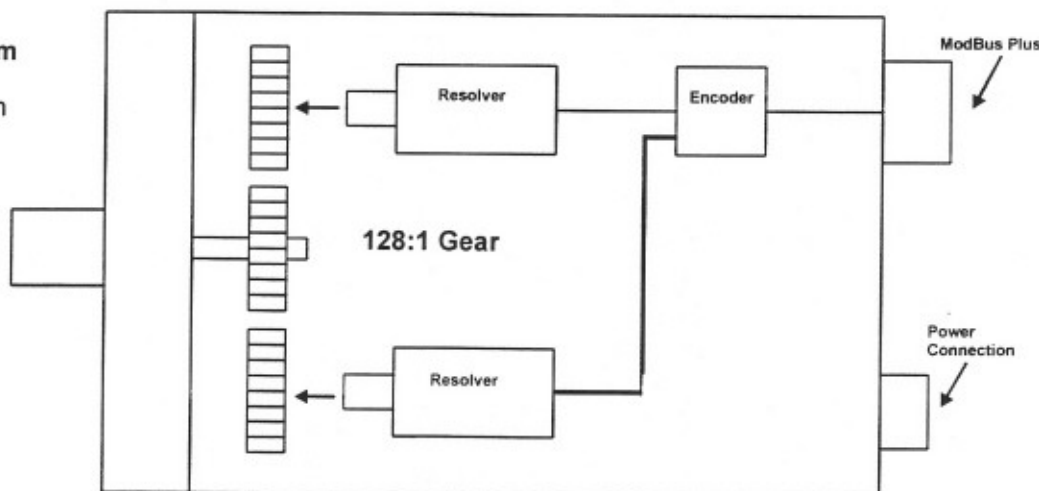
The information is available in "global register" #1 and 2 from this unit. It can also be explicitly read from registers 40001 and 40002 in this unit.

Switches on a "DIP" switch are provided to allow selection of the ModBus Plus Node Address of this resolver (1 to 64) and the direction (clockwise/counterclockwise) of rotation of the resolver that is read from the ModBus Plus Port.

A standard pinout 9-pin D connector is provided for connection to the ModBus Plus network. A second connector is provided on the end cap of the unit for the customer supplied power for the encoder and ModBus Plus interface.

Block Diagram

Multi-Turn
Resolver



Mounting

Autotech resolvers are designed to operate reliably under extremely hostile environments such as continuous mechanical shock, vibration, extreme temperature and humidity changes, oil mist, coolant and solvents. Still ordinary precautions to prevent damage to bearings of any rotation device should be followed to prolong their life.

1. It is recommended that the Autotech encoder mounting bracket (MMB-EN359-010) be used, wherever possible, for size 40 resolvers (see figure, bottom right).

2. If the resolver is to be axially shaft driven, *be sure that the shafts are aligned. Misaligned shafts can destroy resolver bearings.*

3. If a pulley, coupling or sprocket is mounted to the resolver shaft, **DO NOT** hammer or press on the shaft. **DO NOT** force fit anything onto or off of the resolver shaft.

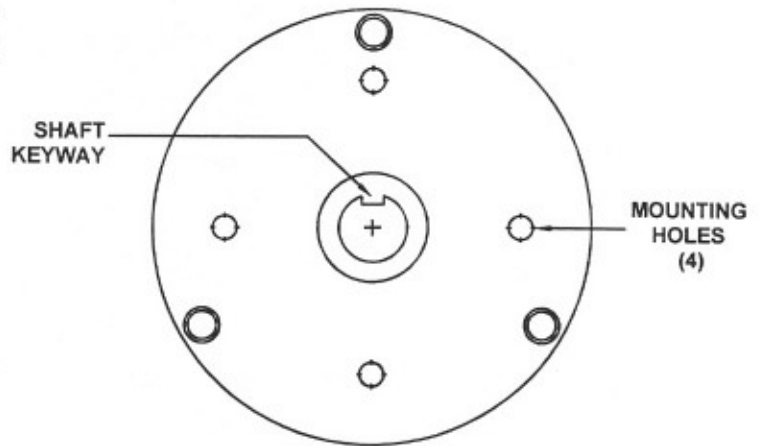
4. If the resolver is belt-driven or chain-driven, do not overtighten the drive belt or chain. Too much side loading (Radial) can destroy the resolver bearings.

5. To maintain the NEMA 13 rating of the resolver, the following precautions must be taken:

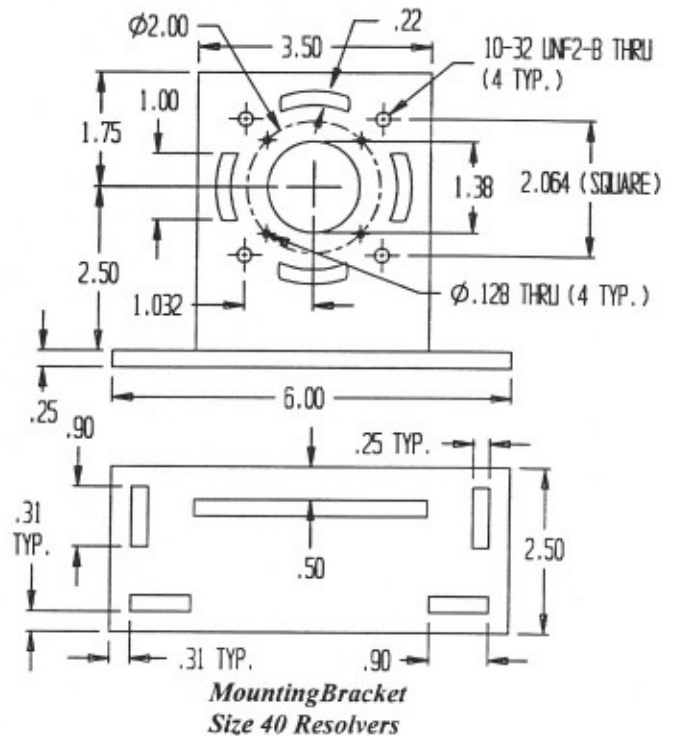
- Sealing compound must be used when fitting the conduit pipe.
- The bearing seal must be checked once every six months and replaced if necessary. Lubricating the bearing seal periodically prolongs its life.

6. Zero Reference: For both resolvers, the approximately zero reference may be located by aligning the shaft as shown in the figure, upper right.

Zero Reference



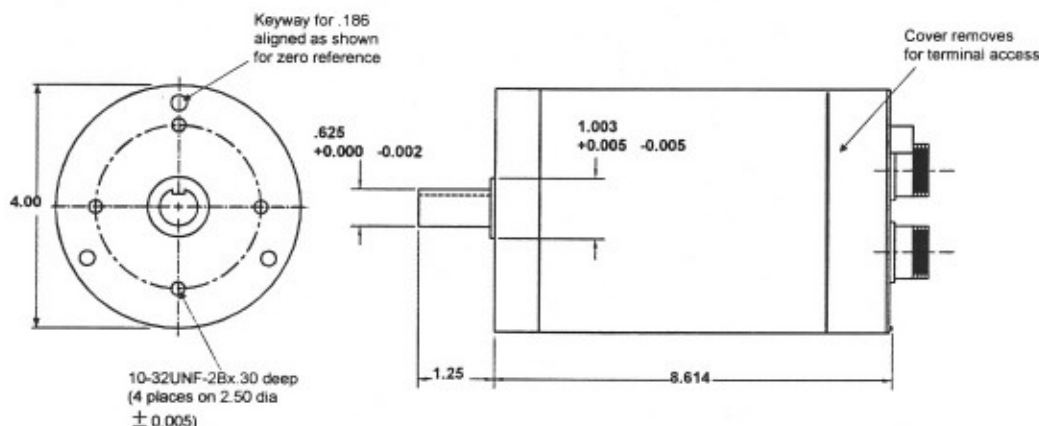
Size 40 resolvers are at approximately zero when the shaft key way is aligned with mounting hole and conduit fitting.



Outline Dimensions

The outline dimensions of the ModBus Plus Multi-Turn Resolver are shown in the following diagram.

SAC-RL210-MBP



Wiring

Grounding and Shielding

1. Resolver wiring must be done using twisted pairs in cable with an overall foil shield. The twisted pairs must be wired as per wiring instructions. See "How to Order" section for suitable cable offered by Autotech.
2. It is recommended that the shielded resolver cable be routed in its own conduit or cable tray.
3. All shielded resolver cable must be kept at a minimum distance of 2 inches from all high voltage or inductive wiring.
4. All shielded resolver cable must be kept at a minimum distance of 12 inches from all motor wiring controlled by AC or DC drives.
5. All ground planes (chassis grounds) in the total system must be held to the same RF potential by good metallic connections to building frames, conduit or wiring trays.
6. The shield drain wires may be terminated in one of two ways.
 - a) Connected to chassis ground at each end and not connected to signal reference at any point in the system.
 - b) Connected to signal reference at the decoder only. The shield drain should remain unconnected at the resolver end and the shield should not touch earth ground at any point in its run.

NOTE: Resolvers with MS connectors have shield drain wire pre-terminated for method "a)", above.

Method a) is recommended for all Autotech products. In certain circumstances, in unusual EMI conditions, method b) may be necessary after consulting factory.

7. ModBus Plus Network Cable: Single twisted shielded pair cable. Modicon 97-9841-XYZ Series or equivalent.

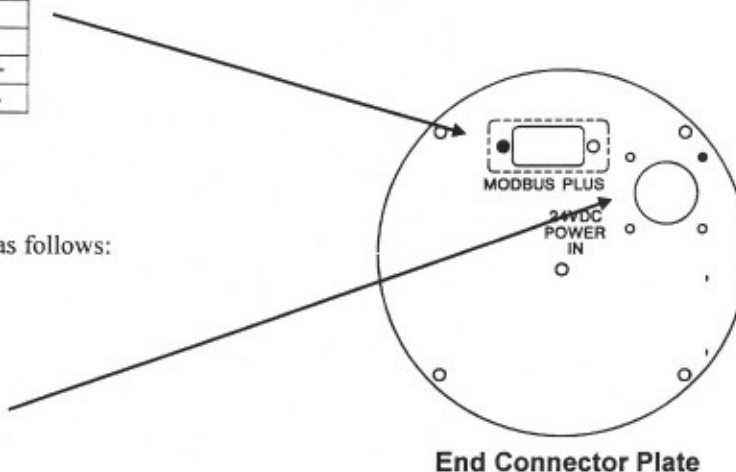
Wiring for SAC-RL210-MBP Connectors

| Wiring Table for ModBus Plus 9-Pin Female D connector | |
|--|------------|
| Pin # | Function |
| 1 | Shield |
| 2 | Com Data + |
| 3 | Com Data - |

Power Connection

The 24 VDC power connector pin-out is as follows:

| Wiring Table for DC Power Connector | |
|-------------------------------------|----------------|
| Pin # | Function |
| 1 | +10 to +30 VDC |
| 2 | not used |
| 3 | DC common |
| 4 | not used |
| 5 | Chassis ground |
| 6 | not used |



End Connector Plate

The mating connector for this connection is RDE P/N RC-06S1N121700.

Setup

DIP Switches

Before operation you will need to set the Node Address and Direction for the resolver. To do this, you must gain access to the Dip Switches (SW3), located inside the unit. To access the circuit board (ASY-RL210-MBP) where the SW3 is located, you will need to perform the following steps:

CAUTION

Use caution when removing and securing the resolver cover plate. Failure to do so may damage the unit.

1. Remove four screws from end plate.
2. Remove gasket separating circuit board from end plate.
3. Locate SW3 on board. (See figure to right).
4. Set the SW3 Dip Switches to the appropriate ON/OFF positions in accordance with your application needs and the instructions below.

Please note: SW1 and SW2 are used internally and are not located on this circuit board. SW4 is located on this board. Switch 8-1 must be ON, while the remaining 7 switches must be set to OFF to allow the unit to operate properly. SW3 is used to set the Node Address and Direction. See figure to your right for location of switch 3.

Setting the SW3 DIP Switches

NODE ADDRESS

The Node Address Range is 1 to 64. The Node Address is set by switch SW3 positions 1 to 6. The value is coded in binary on the switches and is incremented by one to arrive at the address. See the table on the following page for settings for all Node Addresses.

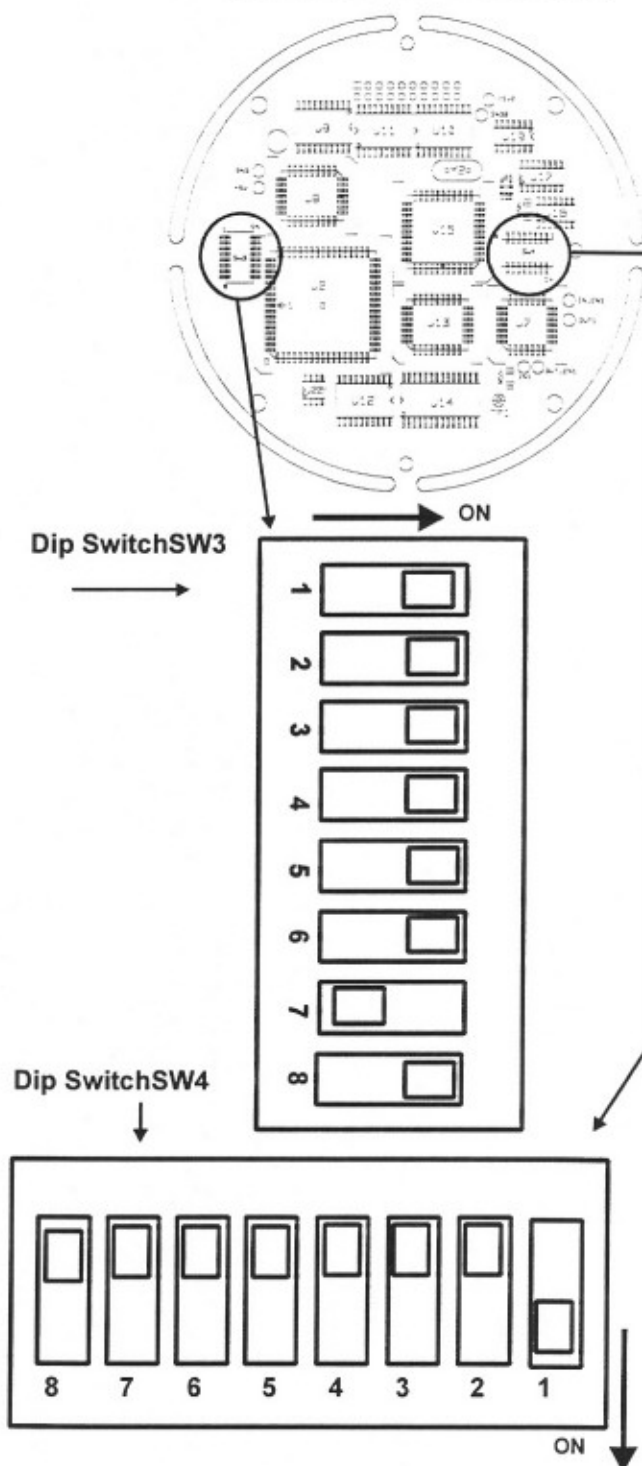
For example, all switches ON = node 1, all switches OFF = node 64, switches 1 and 2 OFF = node 4. To set Node Address = 37: set SW3-1 = ON, SW3-2 = ON, SW3-3 = OFF, SW3-4 = ON, SW3-5 = ON, SW3-6 = OFF.

Position 7 of SW3 (SW3-7) is not used and should be in the OFF position.

DIRECTION

Position 8 of switch SW3 (SW3-8) is used to control the direction of the resolver's output count. The OFF position will result in increasing count in the clockwise direction. ON will increase in CCW direction.

ASY-RL210-MBP Circuit Board



NODE ADDRESS Settings Table

As stated previously, the Node Address Range is 1 through 64. The Node Address is set by switch SW3 position 1 to 6. Please select the corresponding switch position for an appropriate Node Address as shown in the table below.

| Node Address | SW3-1 | SW3-2 | SW3-3 | SW3-4 | SW3-5 | SW3-6 |
|--------------|-------|-------|-------|-------|-------|-------|
| 1 | On | On | On | On | On | On |
| 2 | Off | On | On | On | On | On |
| 3 | On | Off | On | On | On | On |
| 4 | Off | Off | On | On | On | On |
| 5 | On | On | Off | On | On | On |
| 6 | Off | On | Off | On | On | On |
| 7 | On | Off | Off | On | On | On |
| 8 | Off | Off | Off | On | On | On |
| 9 | On | On | On | Off | On | On |
| 10 | Off | On | On | Off | On | On |
| 11 | On | Off | On | Off | On | On |
| 12 | Off | Off | On | Off | On | On |
| 13 | On | On | Off | Off | On | On |
| 14 | Off | On | Off | Off | On | On |
| 15 | On | Off | Off | Off | On | On |
| 16 | Off | Off | Off | Off | On | On |
| 17 | On | On | On | On | Off | On |
| 18 | Off | On | On | On | Off | On |
| 19 | On | Off | On | On | Off | On |
| 20 | Off | Off | On | On | Off | On |
| 21 | On | On | Off | On | Off | On |
| 22 | Off | On | Off | On | Off | On |
| 23 | On | Off | Off | On | Off | On |
| 24 | Off | Off | Off | On | Off | On |
| 25 | On | On | On | Off | Off | On |
| 26 | Off | On | On | Off | Off | On |
| 27 | On | Off | On | Off | Off | On |
| 28 | Off | Off | On | Off | Off | On |
| 29 | On | On | Off | Off | Off | On |
| 30 | Off | On | Off | Off | Off | On |
| 31 | On | Off | Off | Off | Off | On |
| 32 | Off | Off | Off | Off | Off | On |
| 33 | On | On | On | On | On | Off |
| 34 | Off | On | On | On | On | Off |
| 35 | On | Off | On | On | On | Off |
| 36 | Off | Off | On | On | On | Off |
| 37 | On | On | Off | On | On | Off |
| 38 | Off | On | Off | On | On | Off |
| 39 | On | Off | Off | On | On | Off |
| 40 | Off | Off | Off | On | On | Off |
| 41 | On | On | On | Off | On | Off |
| 42 | Off | On | On | Off | On | Off |
| 43 | On | Off | On | Off | On | Off |
| 44 | Off | Off | On | Off | On | Off |
| 45 | On | On | Off | Off | On | Off |
| 46 | Off | On | Off | Off | On | Off |
| 47 | On | Off | Off | Off | On | Off |
| 48 | Off | Off | Off | Off | On | Off |
| 49 | On | On | On | On | Off | Off |
| 50 | Off | On | On | On | Off | Off |
| 51 | On | Off | On | On | Off | Off |

| Node Address | SW3-1 | SW3-2 | SW3-3 | SW3-4 | SW3-5 | SW3-6 |
|--------------|-------|-------|-------|-------|-------|-------|
| 52 | Off | Off | On | On | Off | Off |
| 53 | On | On | Off | On | Off | Off |
| 54 | Off | On | Off | On | Off | Off |
| 55 | On | Off | Off | On | Off | Off |
| 56 | Off | Off | Off | On | Off | Off |
| 57 | On | On | On | Off | Off | Off |
| 58 | Off | On | On | Off | Off | Off |
| 59 | On | Off | On | Off | Off | Off |
| 60 | Off | Off | On | Off | Off | Off |
| 61 | On | On | Off | Off | Off | Off |
| 62 | Off | On | Off | Off | Off | Off |
| 63 | On | Off | Off | Off | Off | Off |
| 64 | Off | Off | Off | Off | Off | Off |

Operation

REGISTER DATA

The resolver data can be read in binary format (range 0 to 131071) in registers 40001 and 40002. Register 40002 contains the 17th bit in its LSB. Register 40001 contains the other 16 bits. Register 40003 contains information about the type of device this is and the revision of the software. The most significant 8 bits are the device type. For this product these will be 00000010. The 8 least significant bits are the software revision code, represented as an ASCII code.

GLOBAL DATA

The resolver data is broadcast in binary format (range 0 to 131071) in this node's first two global registers. The third will contain device type and software revision information as described above.

Specifications

| Mechanical | | | |
|-----------------------|-----------------|--------------------|--------------------|
| Specification | Condition | SAC-RL210-MBP | Unit |
| Housing Size | | Size 40 (4.0" dia) | |
| Max. Starting Torque | @ 25° C | 8 | oz-in |
| Moment of Inertia | | 45 | gm/cm ² |
| Shaft Size | | 5/8 | inch |
| Max. Shaft Loading | <i>Axial</i> | 50 | lbs |
| | <i>Radial</i> | 100 | lbs |
| Bearing life | @Max. Mfr. Spec | 2x10 ⁹ | Revolutions |
| Approx. Weight | | 6.5 | lbs |
| Environmental | | | |
| Shock | for 11 mSec | 200 | g |
| Vibrations | 10-2000 Hz | 20 | g |
| Operating Temperature | | 0 to 60° | C |
| Storage Temperature | | -40 to +85° | C |
| Enclosure | | NEMA 13 | |
| Electrical | | | |
| Power Supply | | | |
| Voltage range | | 10-30 | VDC |
| Input current | @24VDC | 450 | mA |

How to Order

ModBus Plus Multi-Turn Resolver

SAC-RL210-MBP Multi-Turn resolver package with 128:1 gear train built in, size 40 housing, 5/8" shaft diameter, heavy duty bearing, NEMA 13 housing

Accessories

Couplings

CPL-005/8-5/8 5/8" to 5/8" flexible coupling

Mating Connectors

ECM-06POS-001 Connector for Power Supply (RC-06S1N121700)

ECM-09PIN-002 9-Pin DB mating

Mounting Bracket

MMB-EN359-010 Mounting bracket for size 40 resolvers

WARRANTY

Autotech Controls 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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