Autotech Controls
M1151-A MINI-PLS
(SAC-M1151-8XOP)
Instruction & Operation Manual

AVG Automation
Autotech Controls
343 St. Paul Boulevard
Carol Stream, IL 60188

Telephone: 630-668-3900
800-TEC-ENGR

Fax: 630-668-4676

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M1151-A MINI•PLS™

Instruction Manual

Introduction

The Mini PLS family, since its introduction to the market, has set new standards for speed, precision and reliability. While retaining the key features of the Mini PLS family, the M1151 features an incredibly small size and a simple man-machine interface. Now, Autotech has expanded the functions of the M1151 to serve the specialized needs of the industrial control marketplace.

Smallest PLS

The state-of-the-art design of the M1151, utilizing surface mount technology, makes it possible to package a full function PLS in 1.8" x 3.6" x 5.7" (HxWxD). With 16 outputs in this compact size, the M1151 is the smallest PLS available on the market. The space saving housing (6.5 sq. in. panel space) allows a M1151 retrofit to crowded control panels.

Simple Creative Keyboard

The creative engineering from Autotech has made it possible to program all the PLS functions utilizing only five programming keys. With these five self-explanatory programming keys, the M1151 is extremely simple to program - no complex key sequence needs to be remembered nor do you need to carry any note cards.

Simultaneous Display of Channel Number, "On" and "Off" Setpoints

The large (.4") very bright LED display provides good visibility up to 30 feet in plant environments. The user-friendly front panel simultaneously displays the correlated parameters such as channel number, "On" and "Off" setpoints or program number, angle, and RPM allowing a simple and easy-to-understand man-machine interface.

Patented "↑ " and "↓ " Keys to adjust Offset and speed compensations as well as Setpoints, even in full motion

Resolver alignment to machine "zero" as well as fine tuning the machine in motion is accomplished through our patented "↑ " and "↓ " keys which increment or decrement the machine offset or the setpoints.

Individual Channel Speed Compensation

Relays and solenoids, because of their mechanical nature, have inherent fixed delays when activating, varying from 10 ms. to as much as 30 ms. A relay with a 10 ms turn on delay will cause as much as a 55 degree shift in operation at 600 RPM. Each channel may be programmed with individual speed-dependent advances to compensate for fixed delays attributed to relays and solenoids. Speed compensation is fully adjustable from 0 to 35.9 degrees advance per 10 RPM.

High Speed Operation, 135 μs Scan Time

The M1151 Mini PLS can operate up to 1800 RPM. The unit maintains a repeat accuracy of 135 μs.

Multiple Program Storage Reduces Down-Time at Job Changeovers

The M1151 Mini PLS can internally store four independent programs for different jobs. With a preprogrammed M1151 for different product runs, the product changeover is as simple as pressing the MODE and INC / DEC keys to select the program corresponding to the job. Remote selection of PLS programs may be accomplished by a P.L.C. or an external selector switch.

Built-in Tachometer and Motion Detector

The built-in tachometer displays the shaft speed in RPM simultaneously with the position display. Additionally, the built-in motion detector continuously monitors shaft speed and allows the programming of high and low RPM limits for the motion output. The motion detector status is indicated on the front panel by an indicator LED.

Optically Isolated Inputs and Outputs

Optically isolated inputs and outputs are standard to provide enhanced noise immunity and ensure operational integrity of the M1151 Mini PLS in harsh industrial environments.

Internal Diagnostics

The M1151 Mini-PLS has built in circuitry which continually monitors the operation of the unit. If any of the 6 resolver wires break or short together, the Broken Wire Detect circuitry will cause a fault condition. A fail-safe fault output is provided which is energized ONLY if the resolver cable is intact, the customer power supply is present, the line voltage is within specifications, and the processor is not in reset. The fault output will de-energize if the M1151 detects any of these faults.

Brake Wear Monitor

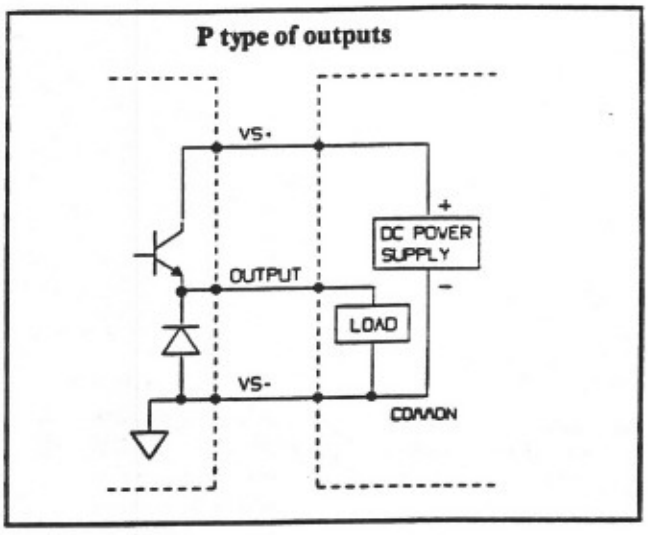
The optional M1151 Brake Monitor automatically measures the time in milliseconds from an input brake signal until the resolver shaft stops rotating. If stopping time is greater than programmed danger limit, the fail-safe danger output is deenergized. The M1151 Brake Monitor is normally applied as an indication control on metal stamping presses. The brake wear monitor uses one PLS channel.

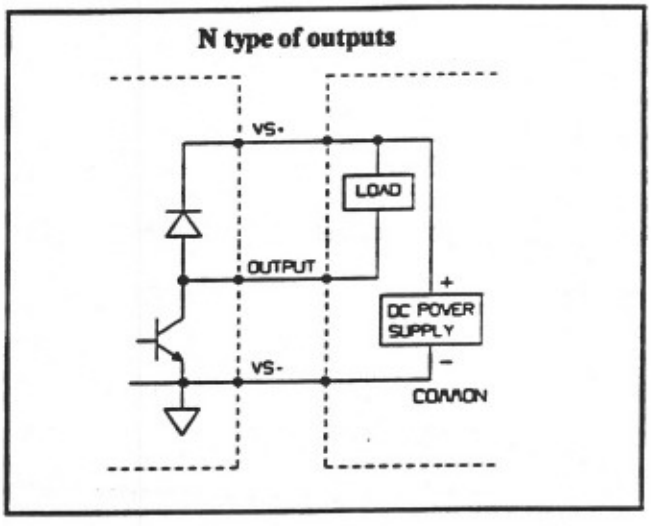
Front Panel Selectable Analog Output: Position or Tachometer

All the analog options are front panel selectable, relieving the user from ordering specific analog output format or setting DIP switches. Moreover, if the application requirements change, they can be easily accommodated by keying in the appropriate information.
The M1151 unit can provide either position or tachometer in the analog form. The following ranges are available and front panel selectable:

1. 0 to 10V
2. —10 to + 10V
3. 0 to 5V
4. —5 to + 5V
5. —2.5 to 2.5V
6. 4 to 20 mA sourcing
7. 4 to 20 mA sinking

Typical Digital Output Configuration

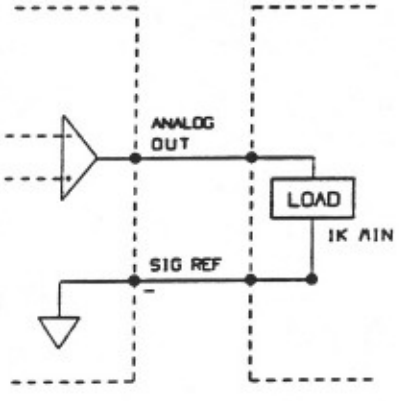




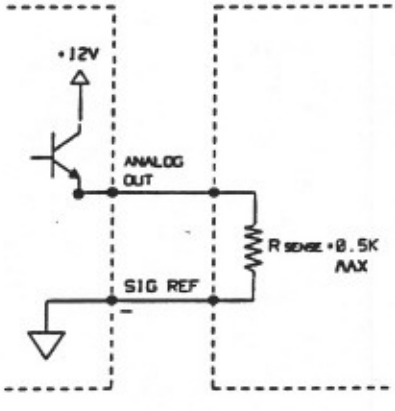
Analog Outputs

Note:
In the 4-20mA **sinking** mode V_{sink} **can only be + 12V.** Failure to connect the sensing resistor properly will result in the damage to the M1151 unit.
It is recommended that in the 4-20mA modes the voltage across the current sensing resistor be taken into a differential input.

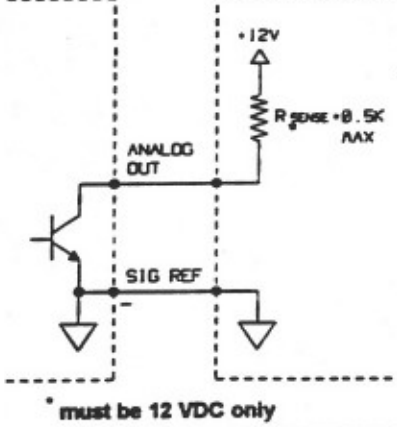
Analog Voltage Output



4-20 mA Sourcing



4-20 mA Sinking



* must be 12 VDC only

Specifications

POWER REQUIREMENTS

DC Power:
11 to 28 VDC only,
350 mA at 12V typ,
150 mA at 24V typ.
Operating Temperature: —10F° to 130°F (—23°C to 55°C)
System Resolution: 12 Bits
Scale Factor: Programmable, 16 to 999
Offset: Programmable, °0 to full revolution.
Scan Time for Complete System Execution:
135 microseconds
If Brake Time measurement is active, add 42 microseconds to normal scan time.
Position Signal:
Autotech's Series RL100, E6R, E7R, or E8R Resolvers
Cable Length between Resolver and M1151:
2500 feet shielded
Resolver Cable: Autotech's, CBL-10T22-xxxx
Maximum Resolver Shaft Speed: 3600 RPM
Resolver-to-Digital Decoder Tracking Speed: 1800 RPM

OUTPUTS:
Types Of Outputs:
PNP Source Transistor:
Logic True: Transistor On, 1.7v Drop @100 mA;
Logic False: Transistor Off, 0.2 mA Leakage @ 50v
NPN Sink Transistor:
Logic True: Transistor On, 1.1v Drop @100 mA;
Logic False: Transistor Off, 0.1 mA Leakage @ 50v
Number of PLS Outputs:
7 or 6 PLS and 1 brake wear
Number of ON/OFF Setpoints per channel:
Channel # 1: 1 dual setpoint;
All other channels: Counts per rev + 2
Motion Detector:
Low Setpoint: up to 998 RPM max.
High setpoint: up to 999 RPM max.
Output: same as PLS output
Analog: For voltage and current see figs above.
Optical Isolation:
1500 Vrms standard on all I/O
(except resolver and analog velocity signals)

Remote Power Relay Outputs

For Cam and Motion outputs requiring higher current ratings, a separate Remote Power Relay chassis Autotech's part number, ASY—RLYCH—xxxx, can be used. The relay chassis is connected to a unit having N type outputs using a prewired cable.
Relay Chassis Input Power: 120 VAC 50/60 Hz.
Number of outputs : 8 or 16 cam outputs plus one motion output.
Unit required : N type.
Cable: Prewired with DB15 connector on both ends.
Relays: Relay chassis is available for EM or Solid state relays.
Electromagnetic relays (Part# KSD—A12DC—10A):
120 VAC @ 10 Amp, SPST
Solid State AC relay (Part# **KSS-120AC-3AMP**):
24—280VAC @ 0.2—3 Amp, zero cross-over switching triac output relay,optically isolated
Solid State DC relays
Part# **KSS-60VDC-3AMP**:
9—60VDC @ 3 Amp, optically isolated
Part# **KSS-200VDC-1Amp:**
0—200VDC @ 1Amp, optically isolated

INPUTS
Program Enable, Output enable, External Program Select, Brake Wear & Brake Reset Inputs:
For "P" Type Units:
Enable or True = 11.0 to 28.0VDC @ 13.5 mA max or tied to terminal # 9 on the terminal block.
(terminal 9 is internally wired to Vs+ for P type of units)
Disable or False = 2.0 VDC @ 0.2 mA max or open circuit
For "N" Type units
Enable or True = 1.0 VDC @ -3.0 mA max
or tie to terminal # 9 on the terminal Block
(terminal 9 is internally wired to Vs– for N type of units)
Disable or False = 3.8V DC to 28VDC Max @ -0.2 mA max or open circuit.

How to Order

1. Mini PLS

SAC- M1151-8 x QP **1**	**Mini PLS with DC Power input, 8 output and built-in programmable analog pos or tach output.**

1. ***Type of Output:***
P: PNP Source Transistor
N: NPN Sink Transistor

2. Position transducers

The M1151 requires a single turn resolver as an input device, such as Autotech's RL100, E6R, E7R or E8R series of resolvers. Please see position transducer section for How to Order information on these transducers and appropriate accessories.

3. Remote Power Relay Output Chassis

3.1 Select type and number of output chassis:
(Requires NPN type of outputs)

ASY*-RLYCH-08RL	**Chassis for 8 EM-relay outputs with motion detector output and built-in power supply**
ASY*-RLYCH-08SS	**Above with 8 solid-state relay outputs**
ASY*-RLYCH-16SS	**Above with 16 solid-state relay outputs**

****For 220VAC unit, change the "Y" in ASY to "2" anr***
for 240VAC unit, change the "Y" in ASY to "4"

3.2 Select type and number of output relays: (required in relay chassis)

KSD-A12DC-10A	**10 Amp, SPST EM relay**
KSS-120AC-3AMP	**3 Amp, 120VAC, solid-state AC module**
KSS-60VDC-3AMP	**3 Amp, 9-60VDC, solid-state DC module**
KSS-200DC-1AMP	**1 Amp, 0-200VDC, solid-state DC module**

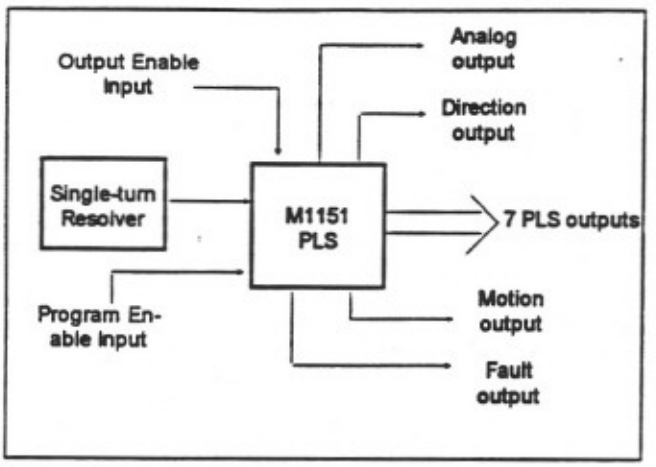
3.3 Cable connecting all M1151 models to relay chassis:

CBL-RLYCH-DA4	**15 conductor cable, with overall foil shield, 4 ft length and sub "D" connector on both ends for interconnection of relay chassis to the PLS**
ECM-15PIN-M11	**15 pin male sub D connector**

Installation and Operation

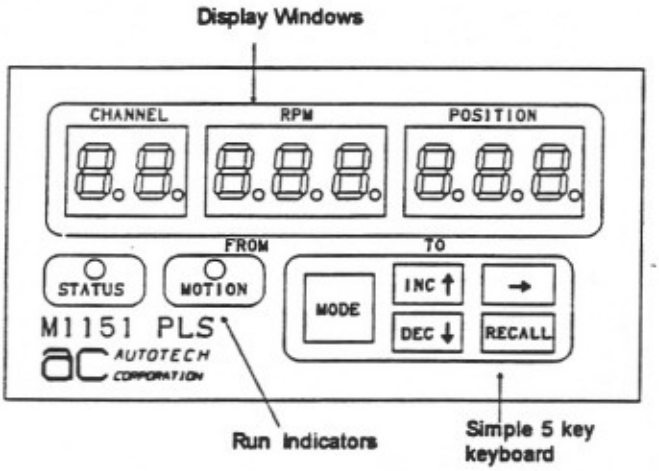
1. Functional Description:

A simplified functional block diagram of M1151-A PLS is shown below:



The M1151 programmable limit switch (PLS) uses a resolver, such as Autotech's RL100, E6R, E7R or E8R series of resolvers, as a position transducer. The M1151 PLS controls 7 or 15 PLS outputs (turns ON/ OFF), according to the programmed position limits for each ouput. The M1151 also offers a motion output, which energizes when the resolver is rotating at a speed within the programmed motion limits.
The direction output from M1151 is energized whenever the position value is increasing. The M1151 continuously monitors its operation and resolver connections, and keeps the Fault output energized during safe operating conditions. The Fault output is deenergized if a fault develops in any monitored parameter.

1.1 Front Panel Indicators and Control



1.2 Display Windows

The 8 digit display is divided into three windows: channel, RPM (or From) and Position (or To). The display in the windows depends upon the programming or display mode of the unit. For details, see programming in section 4.

1.3 Run Indicator Lights

Status LED - Indicates the current "on/off" output status of the selected channel. The Status indicator is active in all 7 modes and shows status of the last selected channel.
Motion LED - Illuminates when the current shaft RPM is within the motion high and motion low limits. The Motion LED displays the status of the 8th output designated as the "Motion output" of the M1151-A PLS. The Motion indicator is always active.

1.4 Keyboard

Mode Key - Each key press steps the operator through each of the seven programming modes:

- **Program Number, Stop Time (B option) and Default Position/Tach Mode**
- **Scale Factor** Programming Mode
- **Offset** Programming Mode
- **Speed Compensation** Programming Mode
- **Dwell Set Point and Caution, Danger for Brake Wear Monitor** Programming Mode
- **Analog output type** (position or tachometer)
- **Analog configuration** (voltage with appropriate range or current 4-20mA)
- **Analog offset calibration**
- **Analog gain calibration**
- **Tachometer full scale value** (only for analog tach)
- **Motion High Limit** Programming Mode
- **Motion Low Limit** Programming Mode

In any of the programming modes, pressing the **Mode** key will terminate the mode currently being programmed, store any changes that have been made, and switch to the next mode.

Inc Key (↑) - Used in all programming modes to increment the value of the setting or limit of the current programming mode.

Dec Key (↓) - Used to decrement the value of the setting or limit of the current programming mode.

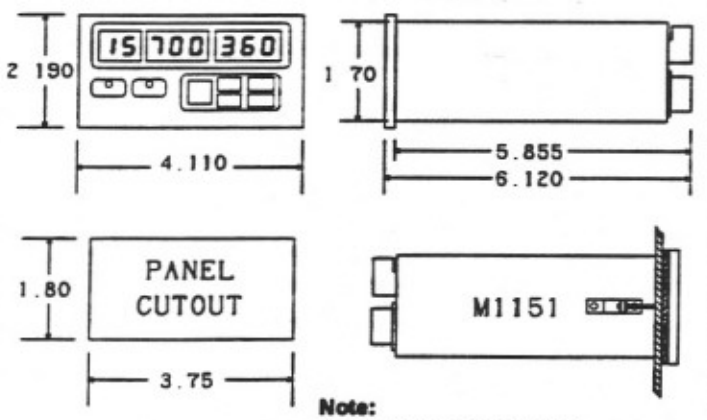
Arrow Key (→) - While in the **dwell set point limit** programming mode, this key changes the current operating window. When in the **dwell set point** programming mode, all 3 display windows are programmable, but the **Inc** and **Dec** keys will correspond to only one window at a time. The **arrow** key selects which of the 3 display windows may be acted upon by the **Inc** and **Dec** keys. In the Speed

Compensation mode, the arrow key allows the Inc and Dec keys to select the channel number or change each channel's speed compensation value. In the Brake Wear Monitor, the (→) key allows programming seconds or milliseconds depending on the window selected. The (→) key is ignored during all other programming modes.

Recall Key - During **dwell set point** programming mode, the Recall key will step the display through each of the dwell set points that have been programmed for the selected channel. Recall is **ignored** for all other programming modes.

2. Mounting

The M1151-PLS is housed in an 1/8 DIN panel mount case. The M1151 requires a rectangular panel cutout and mounting holes are not required. Slide the M1151 in through the panel opening with the furnished gasket, insert the two right-angle mounting brackets into the openings on either side of the M1151 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!** Attach the pre-wired rear terminal and DB connector to the M1151 unit to complete the installation.

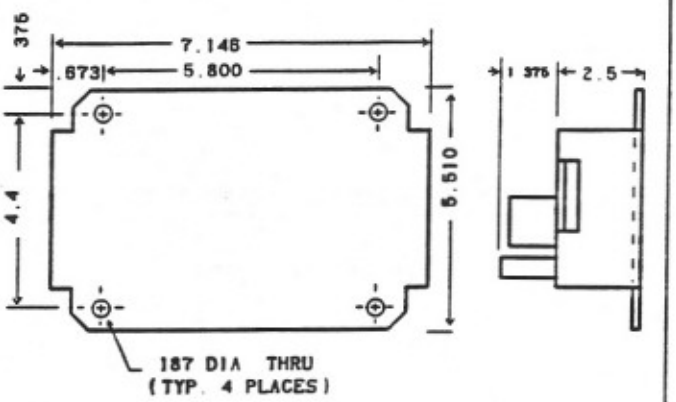


Note:
1. All dimensions in inches
2. Allow a minimum of 2.75 inches for DB connector

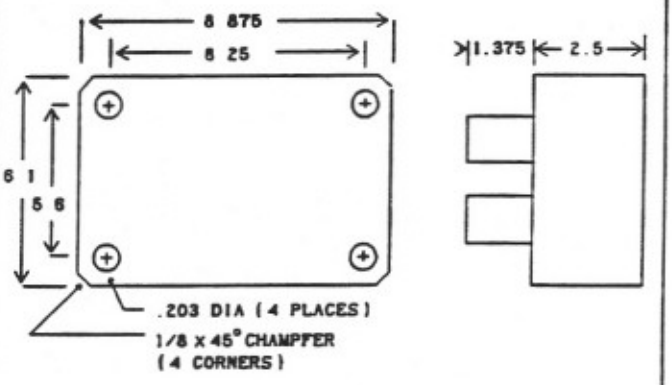
Resolver Cable (CBL-10T22-xxx) Wiring		
S4.. S2..	Blue Black/Blue	Pair
S3.. S1.	Yellow Black/Yellow	Pair
R2.. R1..	Green Black/Green.	Pair

3. Relay Chassis Mounting.

Power Relay Output Chassis, 8 Channel



Power Relay Output Chassis, 16 Channel



Note: Resolver wiring must be twisted pair with overall foil shield

3. Wiring

Notes:

1. The M1151-A **must** be supplied with **12—28VDC** (VS+ , VS—) **only.**

   Warning:
   M1151-A is a **DC Input** unit only

2. Output # 8 is a motion output.

3. Output wiring to other electronic devices (programmable controls) must use shielded cable, with shield connected to a good earth ground at both ends.

4. No special tools are required for wiring input/output devices to the MINI-PLS.

5. Pre-wire terminal blocks before attaching them to the M1151, for easier installation.

6. Load for the Analog output version is 1K Ohm minimum for voltage output and 0.5 K Ohm maximum for current loop output.

7. External Program select inputs may be directly wired to a PLC DC output sourcing card for "P" type of outputs and to a PLC DC output sinking card for "N" type. The Common of the card must be wired to VS- (DB15-2).

8. The Output Enable input, when FALSE, deenergizes all outputs including the FAULT and Direction outputs.

9. **All** logic level wiring (including resolver and external power supply) must be done using **overall foil shielded cables, with shields and equipment** grounded.

10. 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.

11. All ground planes on which the M1151 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.

12. All shielded cable must be kept at a minimum distance of 2 inches from all high voltage or inductive wiring.

13. All shielded cable must be kept at a minimum distance of 12 inches from all motor wiring controlled by AC or DC drives.

14. The table given below describes the pin functions of DB-15 connector cable .

DB15 Connector's pin functions
***Cable:* CBL-15S22-DAxxx**

Pin#	*Cable Color*	*Connector A*	*Connector B*
1	Black	NC	NC
2	White	VS (–) (DC supply common)	VS (–)
3	Red	VS+ (Customer output power supply)	VS+
4	Green	Fault Output	Direction Output
5	Orange	*Channel 7	NC
6	Blue	Channel 5	NC
7	White/Black	Channel 3	NC
8	Red/Black	Channel 1	NC
9	Green/Black	VS –	VS –
10	Orange/Black	VS + (same as pin # 3)	VS +
11	Blue/Black	Output Enable	NC
12	Black/White	Motion Output	NC
13	Red/White	Channel 6	NC
14	Green/White	Channel 4	NC
15	Blue/White	Channel 2	NC

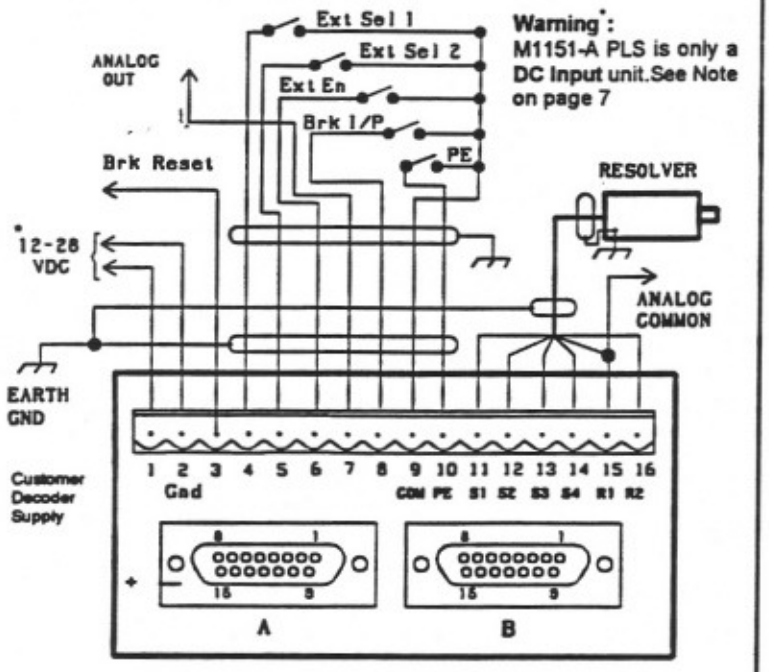
Notes

1. For customer decoder supply and output supply, one power supply may be used with the resultant loss of optical isolation of the outputs

2. To enable output, connect output enable pin 11 of connector A to pin 10 (VS+) for "P" type and pin 11 of connector A to pin 9(VS-) for "N" type.

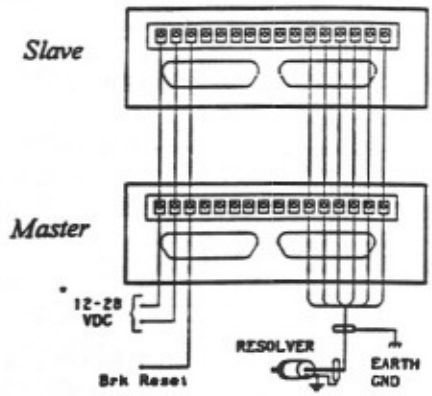
*3. *PLS or Brake wear output.*

3.1 Wiring Diagram



Warning*:
M1151-A PLS is only a DC Input unit.See Note on page 7

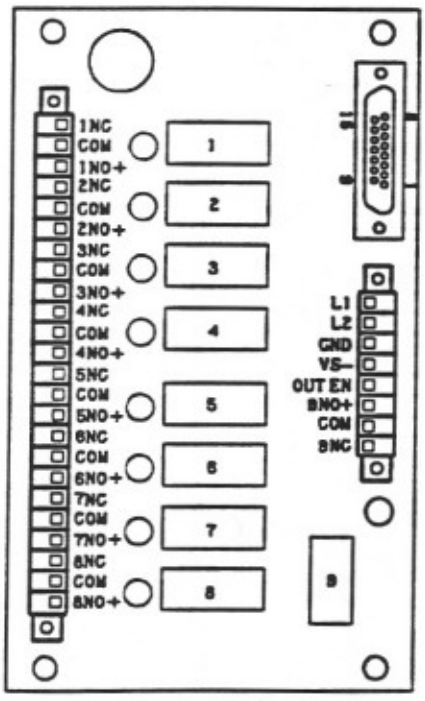
Note:
1. Output enable ONLY on connector A
2. DB connector internally tied to Earth Gnd at connector end through mounting hardware.



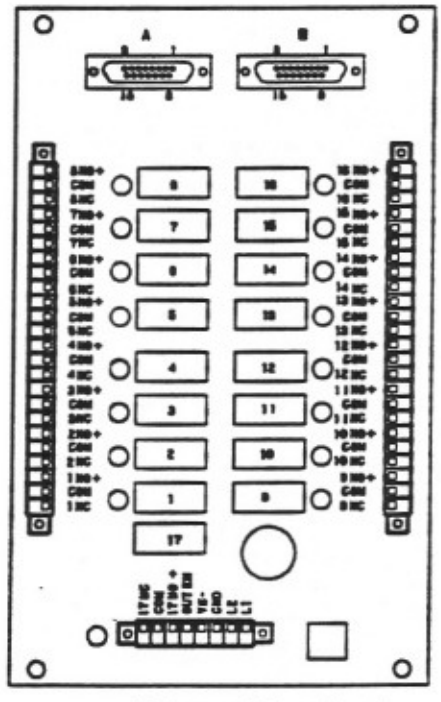
Master Slave wiring (Upto 7 slaves possible)
Slave 1151 is different than Master 1151.

External Program Select Wiring

Program #	Terminal 5	Terminal 4
Prog. 1	Open	Open
Prog. 2	Open	Closed
Prog. 3	Closed	Open
Prog. 4	Closed	Closed



8 output Relay chassis
(Part# : ASY-RLYCH-08xx)



16 output Relay chassis
(Part# : ASY-RLYCH-16xx)

- Use cable CBL-10T22-xxx for wiring resolver (see previous page for wire colors)
- Use cable CBL-RLYCH-DA4 to wire relay chassis to the M1151.
- When an 8 output M1151 unit is connected to 8 output relay chassis, the motion output is available on output relay 8 of the relay chassis, and Fault output is available on output relay 9.
- When a 16 output M1151 unit is connected to 16 output relay chassis, the motion output is available on output relay 16 of the relay chassis, and Fault output is available on output relay 17.

4. Programming the M1151-A PLS

The front panel keys and indicators have been described earlier. Different modes, and corresponding displays in the display windows are listed in the table given below:

Mode	Display Window		
	Channel#	*RPM (From)*	*Position (To)*
Position/Tach (Default)	P1–P4 (Prog #)	Resolver RPM	Resolver Position
Scale Factor	SF	Blank	Current Scale Factor
Offset	OF	Current Offset	Resolver Position
Speed Compenstation (Rate Offset)	Channel #	SC	Current Rate Offset
Brake	dA (danger)	Limit (sec)	Limit (msec)
Dwell Setpoint	Channel #	From (Start)	To (End)
Analog Output Type	AO	Blank	Pos or Tach
Analog Configuration	AC	Voltage with appropriate range or current 4-20 mA	
Analog Offset Calibration	CA	Blank	Current Analog Offset Value
Analog Gain Calibration	CA	Blank	Current Analog Gain Value
Tachometer Full Scale Value	FS	Blank	Current Tachometer Full Scale Value
Low Motion Limit	LO	Low Limit	Blank
High Motion Limit	HI	High Limit	Blank

Following are the guidelines for programming a standard M1151:

1. Before programming the unit, make sure that:
   - **DC power must be + 11 to 28VDC.**
   - The program enable input must be enabled (PE input (terminal # 9 connected to terminal # 10). Terminal # 10 is internally tied to Vs+ (P type) or Terminal # 10 is internally tied to Vs- (N type).
2. **All decimal points** (illuminated on Power Up) is an alert to check the M1151 program. In the **unlikely** event of a power loss while in the **process** of programming, the program entered at power loss may be lost.

NOTE
The Program Enable input is an important safeguard against data pollution by strong industrial noise sources. Programming should **only** be enabled while actually programming the M1151-A.

3. While programming, a flashing status indicator indicates that the M1151 is storing the item programmed into non-volatile memory. Changing modes may be inhibited for this short period.
4. Because of safety concerns, scale factor, program number change, will be locked out if the shaft is moving.

Because of the menu-driven style of key sequences, the M1151 does not have error modes. Illegal key sequences are simply ignored; Incrementing or Decrementing past specific boundaries (as in motion limit programming being limited to 999 RPM) is automatically inhibited by the M1151-PLS.

Pressing the **MODE** key will step the operator through the following programming modes:

- **Scale Factor** (SF)
- **Offset** (OF)
- **Speed compensation mode** (SC)
- **Channel/Dwell Setpoint** (1-7 or 1-15)
- **Danger (dA) Limit**
- **Analog output type** (position or tachometer)
- **Analog configuration** (voltage with appropriate range or current 4-20 mA)
- **Analog offset calibration**
- **Analog gain calibration**
- **Tachometer full scale value** (only for analog tach)
- **Motion High Limit** setting (HI)
- **Motion Low Limit** setting (LO)
- **Change** current operating program (P1-P4).

The MODE key will terminate any programming operation and switch to the next programming mode in the loop. Note: There is not any "get-back" or "erase" key for programming errors; Any program change occurs immediately as the operator inc's or dec's a value. Always use caution when changing any setting.

When in any programming mode, if the keyboard is not pressed during a **1 to 2 minute** timeout period, the M1151-PLS will switch back to the default **position/tach** display mode. This is to prevent the M1151from being accidently left in any programming mode for an extended time. If the timeout occurs while programming, simply use the **MODE** key to return to the desired mode.

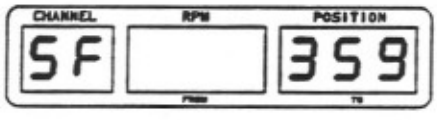
All values, limits, program numbers, and setpoints will retain their information in EEPROM memory indefinitely with or without power applied to the unit. The only item changed on loss of power is the current channel number which defaults to channel one.
Important: If the M1151 unit is operating on a program, for example number P3 and power is removed from the unit. When power returns to the unit, it will remain operating in program number P3.

The following section is organized in the progression most often used when installing the M1151-PLS. Please note that Position, Tach, and limit values in the following examples are simply typical values, and do not mean to show any specific default or standard limits or values.

4.1 Scale Factor Mode

Upon power up, the M1151 will be in the default **position/tach** display mode. The display will appear as follows:

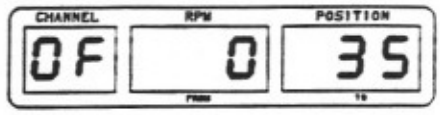
The channel number (and **status** LED) will be set for channel 1. The channel display will briefly identify the current operating program number (P1-P4) and then go blank. The RPM window will display the current shaft speed, and the position window will show the current shaft angle plus offset. The M1151 Brake Wear Monitor unit can also power up in the Stop Time (St) mode, indicating a stop time of 0.000.
Press the **MODE** key to switch to **Scale Factor** mode. The display will indicate:



If programming is enabled, press the **inc** key to increase the Scale factor and press the **dec** key to decrease the scale factor. Please note that scale factor is desired counts per turn minus 1. The range of scale factor supported by M1151 is 16 to 999.

4.2 Offset Mode

From the Scale factor mode, press the **MODE** key to switch to **Offset** mode. The offset is the value added to the current shaft angle to align the machine zero with the resolver zero (avoiding the old practice of mechanically zeroing the shaft encoder/ cam switches). The display shows "OF" (offset) in the **channel** window, the current offset value in the RPM window, and the current shaft angle position in the **position** window.



If programming is enabled, pressing the **inc** or **dec** keys will increase or decrease the current value. Holding the **inc** or **dec** keys down will rapidly change the offset until the desired value is reached. Note that as the offset value changes, the current position and corresponding outputs also change accordingly.

4.3 Speed Compensation Mode

Use the **MODE** key to change from Scale Factor mode to Speed Compensation Mode. Speed Compensation is defined in scale factor units per 10 RPM. The examples below assume a scale factor setting of 359. The channel window will display the current selected channel number (1-15), and the position window displays the current programmed speed compensation for this channel.

Here, channel One has 5.0 degrees of offset at 10 RPM (and 0 degrees of offset at 0 RPM). Use the Inc and Dec keys to view each channel's speed compensation value. If the Speed compensation of channel 2 needs to be decreased, use the arrow key to move to the value display window, i.e. the decimal points change to the rightmost display window.

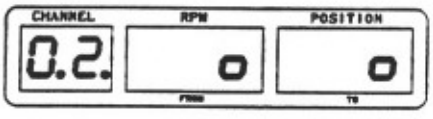
Channel 2 has 8.5 degrees of advance at 10 RPM. Using the Dec key, that value might be reduced to 8.1 degrees, even when the machine is in motion. The Program Enable input must be active to change speed compensation values. Settings may be viewed at any time.

4.4 Channel/Dwell Set Point Mode

Pressing the **Mode** key will step the operator into the **dwell set point** programming mode. The current channel number is in the **channel** display, the "from" set point value is in the RPM display, and the "to" set point value is shown in the **position** display:

Here, the 1st set point dwell for channel 2 will turn on at 136 degrees, and turn off at 180 degrees. If another dwell set point exists for this channel, pressing the **RECALL** will display the next set point dwell:

This dwell turns on at 225 degrees and turns off at 250 degrees. Assume that there are only two set point dwells on channel 2. Pressing **RECALL** a third time will display a NULL set point:



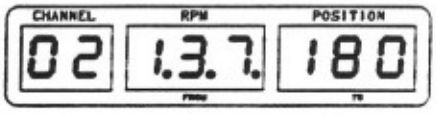
This pair is not an actual set point dwell, but is used to create more set point dwells, as described later. Pressing the **RECALL** a fourth time will again display the first set point dwell:

At this point, some clarification is needed about the decimal points that are illuminated in the channel window. Consider these as a cursor, or pointer, to indicate which window the **inc** and **dec** keys will act upon when pressed. When in the channel window, the decimal points indicate that pressing the **inc** key will switch us to channel 3:

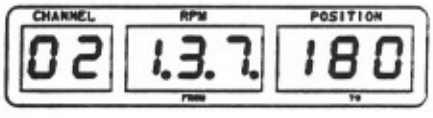
Notice that the M1151 has automatically recalled the first set point dwell for channel 3 as it is selected. Pressing the **dec** key will bring the display back to channel 2:

Note: the following key sequences for section 4.3 will be ignored by the M1151 if programming is not enabled.
Now press the →key. This will move the cursor (pointer) to the "FROM" window:

If the **inc** key is pressed, the "from" part of this dwell will be incremented.



Press the →key again. The cursor (pointer) is now in the "TO" window:



If the **inc** or **dec** keys are pressed, the "to" value of this set point dwell will be incremented or decremented accordingly:

Repeated pressing of the →key will continue to cycle the cursor through all three windows.

4.4.1 Removing a Set Point Dwell

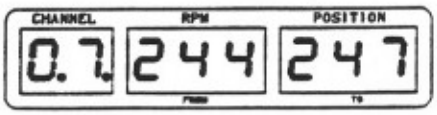
Using the **RECALL** key, display the set point dwell that is to be deleted or erased.
For example, to remove the channel 2 setpoint pair of 137-182:

Press the → key to activate the "FROM" window. Press and hold the **inc** key until the "from" value is the same as the "to" value:

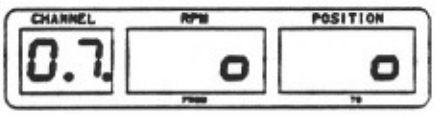
This set point dwell is now deleted. Pressing the **RECALL** key will prove that this set point dwell has been deleted.

4.4.2 Adding a New Set Point Dwell

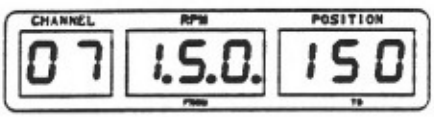
Using the → and the **inc** and **dec** keys, select the channel number that is to receive the new set point dwell, i.e. channel 7:



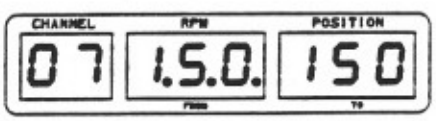
Press the **RECALL** key until the display shows the NULL set point pair:



Use the → key to activate the "from" window. Press the **inc** or **dec** key to set the "from" window to the desired set point beginning "from" value. Notice that the "to" window will always equal the "from" window. Assuming that this set point should start at 150 degrees:



So far, this set point turns on at 150 degrees and turns off at 150 degrees, which means that it doesn't turn on at all, and that we have not created a set point dwell yet. If the **MODE** key is pressed, these two values will be lost. Press the → key to activate the "to" window:

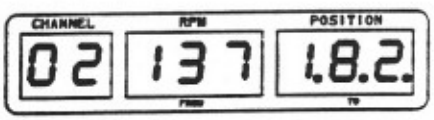


Use the **inc** key to begin increasing the dwell of this set point. Assume that this dwell was to turn off at 190 degrees:

Now we **have** created another set point which turns on at 150 degrees and switches off at 190 degrees. If the **MODE** key is pressed, the set point will still exist as it has now been stored in EEPROM memory.

4.4.3 Merging Two Existing Set Point Dwells

Assume that the M1151 is set on channel 2 and there are two set point dwells: 137-182 and 244-247. Use the **RECALL** key to recall the first set point dwell and set the cursor on the "to" window:



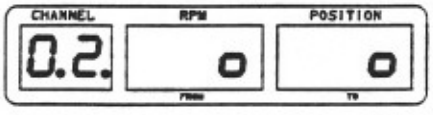
Press and hold the **inc** key to expand the dwell of the first set point. If you stop just short of overlapping the second set point, the display will show:

Now pressing the **inc** key once will change the display to:

The set points are now merged. Pressing the **RECALL** key will now show only one set point dwell (137-247).

4.4.4 Separating One Set Point Dwell Into Two Separate Dwells

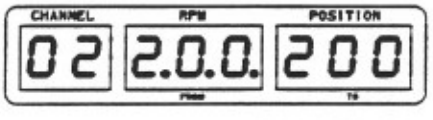
The best way to separate one large dwell into two smaller dwells is to press the **RECALL** key until the null setpoint appears on the display.



For example, suppose there is a setpoint on from 137 to 247 degrees and we would like to separate this dwell into two dwells: 137 to 150 degrees and 200 to 247 degrees. Advance the pointer to the "From" window and inc to 150.

Now advance to the "To" window and inc to 200.

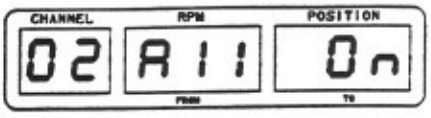
Then go back to the "From" window and inc to 200.



Pressing **RECALL** will now show two dwells: 137 to 150 and 200 to 247.

4.4.5 Turning a Channel Fully On

Press the **RECALL** key until the null setpoint appears on the display. Advance to the "From" window and inc a few counts. Advance to the "To" window and inc one full revolution of counts. Press **RECALL**. 'All On' will appear on the display.



4.4.6 Opening a Dwell in a fully On Channel

Advance to the "From" window and inc or dec to the On ("From") value in the new dwell. Now advance to the "To" window and dec to the Off ("To") of the new dwell. Pressing **RECALL** will indicate the new dwell value.

4.5 Analog Output Selection:

Two kinds of analog output are available: position and tachometer. When Analog Output Mode is entered, one of the following two displays will appear:

To change from the Position output to the Tachometer output, press the **INC** key once. To change from the Tachometer to the Position, press **DEC** key once.
Press **MODE** key to save the displayed option, and to select the Analog Configuration Mode.

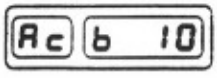
4.5.1 Analog Configuration Selection:

Seven analog output ranges are available. The analog output can be:

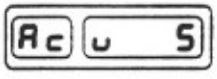
1. 0 to + 10 Volts
2. -10 to + 10 Volts
3. 0 to + 5 Volts
4. 5 to + 5 Volts
5. -2.5 to + 2.5 Volts
6. 4 to 20 mA sourcing
7. 4 to 20 mA sinking

Use INC and DEC keys to select a desired range. The order of the ranges from bottom to top (using INC key) is as follows:

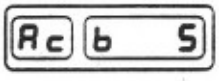
Unipolar 10 (0 to + 10 Volts)



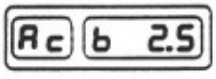
Bipolar 10 (-10 to + 10 Volts)



Unipolar 5 (0 to + 5 Volts)



Bipolar 5 (-5 to + 5 Volts)



Bipolar 2.5 (-2.5 to + 2.5 Volts)

Current Loop Sourcing (4 to 20 mA)

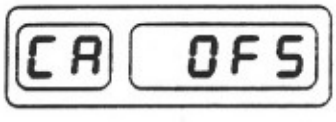
Current Loop Sinking (4 to 20 mA)

Press MODE key to save the displayed option, and to advance to Offset Calibration Mode.

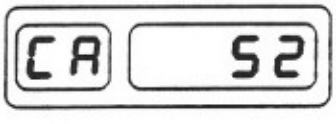
NOTE:
For voltage configurations the minimum load is 1K and for current configurations the maximum load is 0.5K.

4.5.2 Offset Calibration Mode.

When this mode is entered, the following is displayed:



Voltage Modes:
To start calibrating, attach a voltmeter to the analog output. Press the **ARROW** key, a number between 0 and 255 will be displayed:



Unipolar Ranges:
Press INC or DEC key until voltmeter reads 0.000 volts or as close to it as possible.

Bipolar Ranges:
Press INC or DEC key until voltmeter reads:
1. -10.000 volts for bipolar 10;
2. -5.000 volts for bipolar 5;
3. -2.500 volts for bipolar 2.5.

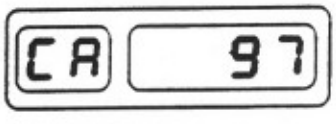
Current Modes:
Attach the voltmeter **across** the current sensing resistor.
Press INC or DEC key until voltmeter reads
V = (4 * Rsense)mV ,
where Rsense is the value of the current sensing resistor in Ohms.

Press MODE key to save this calibration value, and to advance to Gain Calibration Mode.

4.5.3 Gain Calibration.

When this mode is entered, the following is displayed:

Voltage Modes:
Press the **ARROW** key. A number between a 0 and 255 will be displayed:
Unipolar Ranges:



Press INC or DEC key until voltmeter reads:
1. 10.000 volts for unipolar 10;
2. 5.000 volts for unipolar 5.

Bipolar Ranges:
Press INC or DEC keys until voltmeter reads:
1. 10.000 volts for bipolar 10;
2. 5.000 volts for bipolar 5;
3. 2.500 volts for bipolar 2.5.

Current Modes:
Attach the voltmeter across the current sensing resistor.
Press INC or DEC key until voltmeter reads
V = (20 * Rsense) mV,
where Rsense is the value of the current sensing resistor in Ohms.

Press MODE key to save this calibration value.

4.5.4 Tachometer Full Scale Mode.

The next mode depends on the previously programmed information.
If one of the bipolar ranges has been selected, there is one more calibration mode to increase the accuracy of the analog signal.
If analog tachometer output has been selected, there will be a Tachometer Full Scale Mode.
Tachometer Full Scale Programming:
The following screen will appear:

This mode is used to set a full scale tachometer reading that all the other readings will be referenced to. For example, if a full scale value of 500 is programmed, and unipolar 10 volt range is selected, a tachometer reading of 500 rpm will provide a 10 volt analog output.

Use **INC** or **DEC** key to program the desired setting.

The calculations are done according to the formula:

Analog Tach = (Current Tach/Full Scale Tach) * Maximum Voltage for selected range

If bipolar voltage range has been selected, the voltage sign will indicate the direction of the rotation. The clockwise rotation is indicated by the positive voltages, and the counterclockwise by the negative.
If the actual tach reading exceeds the programmed full scale value, the analog output will stay at maximum value for the selected range.

4.6 Motion High Limit Setting Mode

From any of the programming steps in section 4.4, pressing the **MODE** key will step the M1151 unit into the tach motion high limit setting mode. "Hi" will appear in the channel window, and the current tachometer high limit will be displayed in the RPM window.

The position display is blank. Pressing the **inc** or **dec** keys will change this setting if programming is enabled. The M1151 will not inc up past 999 RPM, nor will it dec lower than the Motion Low limit setting. The motion output and corresponding motion LED will turn OFF if the shaft RPM exceeds this limit.

4.7 Motion Low Limit Setting Mode

Pressing the **MODE** key will step the M1151 unit into the Motion low limit setting mode. Use the **inc** or **dec** keys to adjust this lower motion limit. The M1151 will not allow a lower limit of less than zero, nor will it allow the limit to be **inc**'d higher than the current motion high limit setting. The Motion output and corresponding motion LED will be ON if the current shaft RPM is greater than this limit setting, otherwise the output and LED will be OFF.

4.8 Program Number Change and Default Position/RPM Display.

Important: ***Disable all outputs before switching program numbers to avoid activating outputs accidentally.***

- Changing programs is not allowed if:
- programming is not enabled, or
- if the machine is in motion (> 3 RPM)

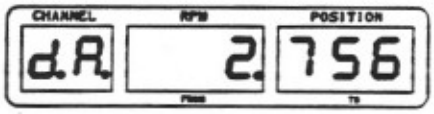
Pressing the **MODE** switch will set the unit temporarily into a mode that will allow the operator to change the current operating program or set up (1-4). The channel display will indicate the current program number and the position and RPM displays will show position and RPM respectively. Once in this mode, the operator has just 15 seconds to use the **inc** or **dec** key to switch to the next operational setup. This changes all rate offsets and dwell set points to those values programmed in by the operator for this program number. In this manner four completely different setups may be stored in the M1151 and selected by the press of a button. The **inc** or **dec** key will step through each of the 4 setups stored in the unit (P1-P4).
After the 15 second timeout, the program number in the channel display will blank out and changing of the program number will be inhibited. To reactivate program selection, simply cycle the **MODE** switch 7 times to reactive program number change mode.

4.9 Brake Monitor Option

The M1151 Brake Monitor automatically measures the time in milliseconds from an input 'Brake' signal until the resolver input shaft stops rotating. Because of the high resolution of the M1151's resolver decoding circuitry, determining that the shaft has actually stopped can be determined within just 0.014648 seconds. This stopping time is then compared to the programmed Danger Time and the Safe output is energized as a result. The additional output channels are programmed as normal PLS outputs. The M1151 Brake Monitor is normally applied as an indication control on metal stamping presses.

4.9.1 Brake Monitor Programming

To enter brake wear mode press **RECALL** key while in position (default) mode. Channel 7 is Danger (safe) output from brake wear monitor which is "Safe Fail", (LED is off for danger or power loss). There is extra input to reset the danger output. If Danger Limit is programmed to be zero, channel 7 may be programmed to be regular PLS output. To program the Danger limit, press the **MODE** key repeatedly until display reads dA.

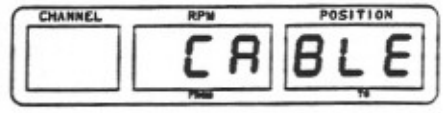


In this example, the .2 in the center window indicates seconds, and the 756 in the right-hand window indicates milliseconds. If the actual stopping time is shorter than 2.756 seconds, the Safe output will remain energized. If the machine stopping time exceeds 2.756 seconds, the Safe output will deenergize.

To program the Danger limit, press the →key to place the cursor key in the center window, then press the **INC** or **DEC** key to change the Danger seconds value. Next, press the →key to place the cursor in the right-hand window and press the **INC** or **DEC** key to change the Danger milliseconds value. Press the → key again to return to the left-hand window.

5.0 Broken Wire Indication

Should one or more of the resolver wires break or become shorted, all outputs including Fault will deenergize and the display will indicate **CABLE.**



M1151-A Troubleshooting Guide

Symptoms	Possible causes
Unable to program unit parameters (Scale Factor, Offset, etc.)	• Program Enable Input (PE) is false. • Machine is moving — programming of several parameters (Scale Factor, Program Number) is disabled if the resolver is turning faster than 3 RPM. • Customer VS+ is below + 8 volts.
Program memory is changing by itself.	• The unit program number has been changed to a different number (P1-P4). • Proper grounding and shielding has not been applied. Sig Ref (R1) and Earth Ground must NOT be tied to-gether. To make sure follow these steps: –Turn power off to unit –Using Ohm meter, measure resistance from terminal R1 to Earth Ground. The reading should be more than 500 K • Inductive loads on outputs must have voltage suppresssion • Program Enable input is TRUE (while this will not cause the program to change itself — keeping it FALSE when not actually programming the unit — ensures that the memory cannot be programmed.)
Position and Tach reading are incorrect.	• Resolver is incorrectly wired. See below steps for a quick check: 1. Turn power off to M1151 unit 2. With main terminal block removed from unit, measure with ohm meter the following: A) Term. R1 to R2 = about 30 ohms B) Term. S1 to S3 = about 55 ohms C) Term. S2 to S4 = about 55 ohms • Resolver cable is not properly grounded and shielded.
Mechanical Zero drifts.	• Mechanical Resolver linkage is loose. • Offset value has been changed.

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