Autotech Controls
M1025 PLS
Instruction & Operation Manual

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MAN-M1025-REV03
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M1025 PLS
Instruction Manual

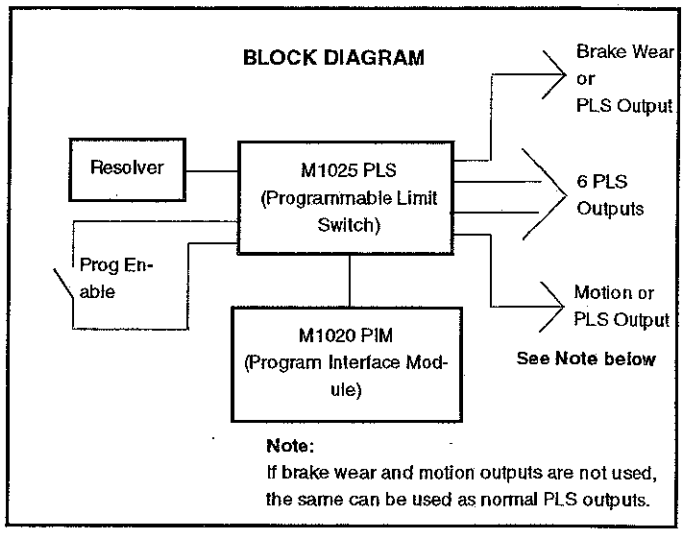
Functional Description

The M1025 Programmable Limit Switch (PLS) system consists of the following components:

- Resolver (such as Autotech's RL100, E6R, E7R or E8R series)
- M1025 PLS (Programmable Limit Switch)
- M1020 PIM (Program Interface Module)

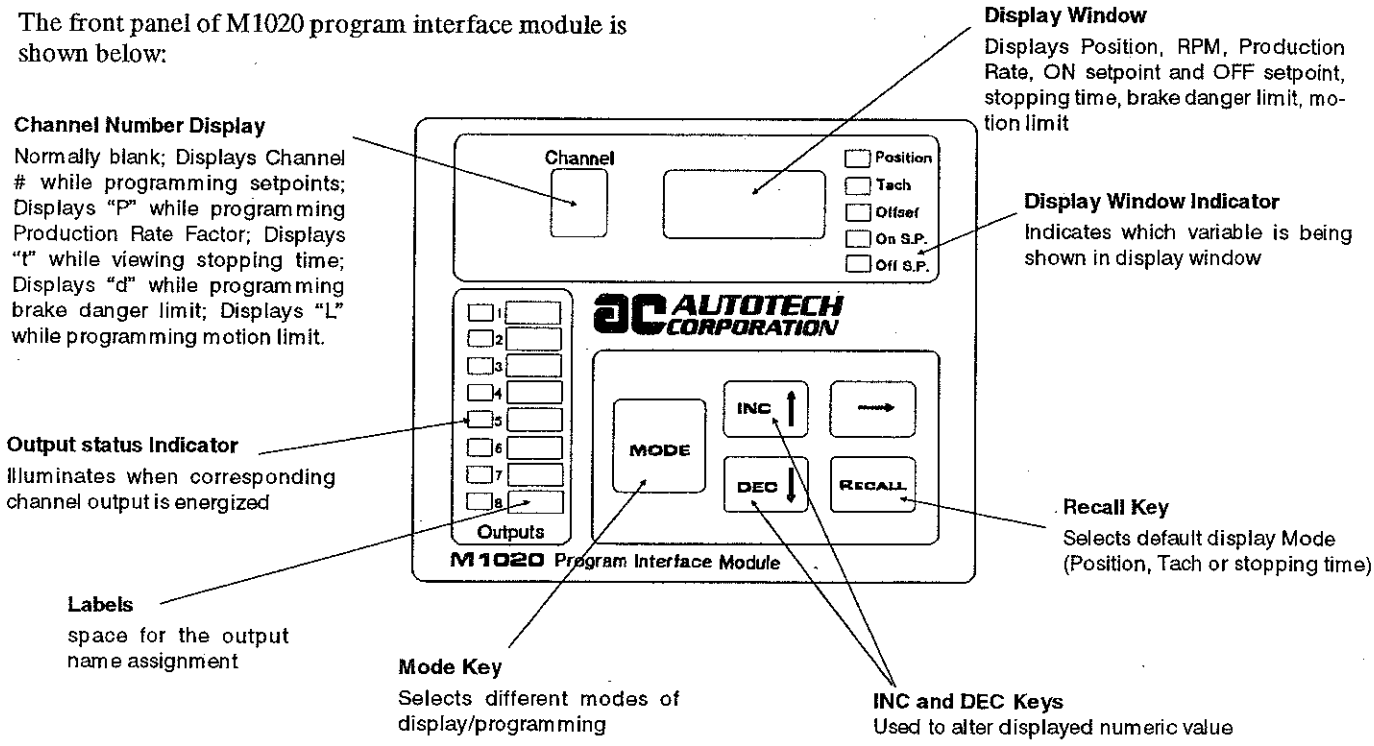
A simplified functional block diagram of the M1025 PLS system is shown in next column.
The M1025 PLS uses a resolver as a position transducer and controls 8 outputs (turns ON/OFF), according to the programmed position limits for each output.

The M1020 programming & display module is used to program the M1025 PLS, and to monitor position and output status. This plug-in module is required only to program and monitor the M1025 PLS. The module is not required to be connected for basic operation of M1025 PLS.



1.1 M1020 Program Interface Module

The front panel of M1020 program interface module is shown below:



Specifications

Power Requirements:
AC Power: 105-135 VAC, 60 Hz, 10 W

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

System Resolution: 10 Bits

Scale Factor: Fixed, 359

Offset: Programmable, 0 to 359

Scan Time: Set point dependant: (430 usec max).

Position Signal:
Autotech's series RL100, E6R, E7R or E8R resolvers

Cable Length Between Resolver And M1025:
2500 ft. shielded

Resolver-to-digital Decoder Tracking Speed:
380 RPM with 1° resolution

Control Inputs:

Program enable:
Needs to be tied to common (common pin is provided) to enable programming. Programming is disabled if this input is left open.

Brake Reset:
When connected to common, it clears the stopping time display and resets the danger output.

Brake Input:
Electromechanical Relay, 120VAC coil. When 120VAC is removed from this input, the brake signal isapplied to the system activating brake wear monitor feature.
Deactivated when the shaft stopping time exceeds the programmed danger limit.

If more than 6 PLS outputs are required, the motion limit output and brake danger output can be used as normal PLS outputs (Refer to section 4.5).

The available output types are:

A. Electromechanical SPST Relay
10 Amp resistive continuous @ 120 VAC

B. Solid state relays.

1. AC output:
120VAC @ 3A; OnN time: < 3ms after zero cross;
OFF time: At zero cross;
Leakage: 2.1 mA @ 120 VAC.

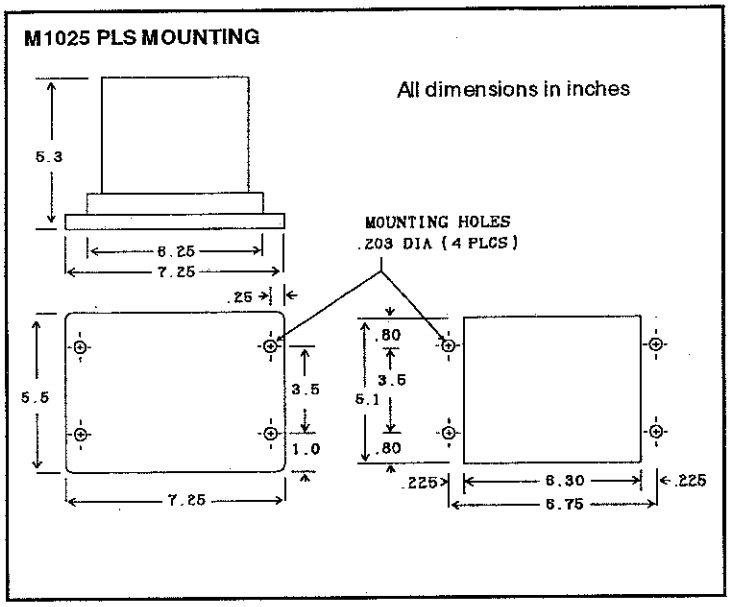
2. DC output:
Up to 60 VDC @ 3A; ON time: 5 µs;
OFF time: 35 µs; Leakage: 0.29 mA @ 15 VDC

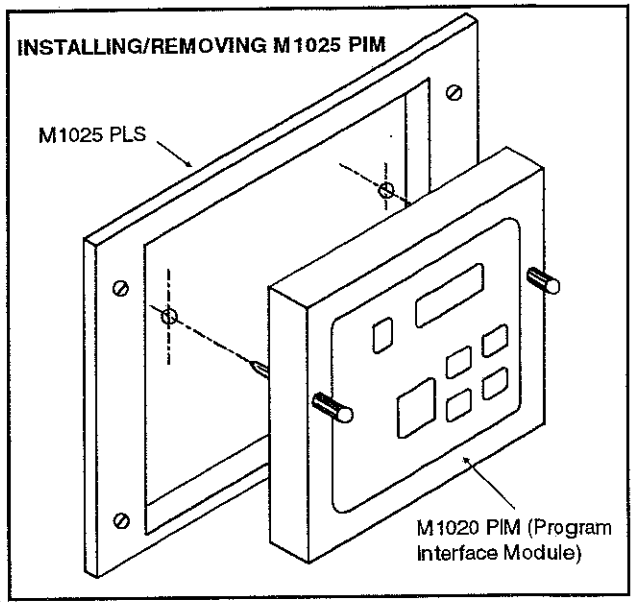
3. DC output:
Up to 200 VDC @ 1A; ON time: 15 µs;
OFF time: 100 µs; Leakage: < 0.01 mA @ 30 VDC

2. Mounting.

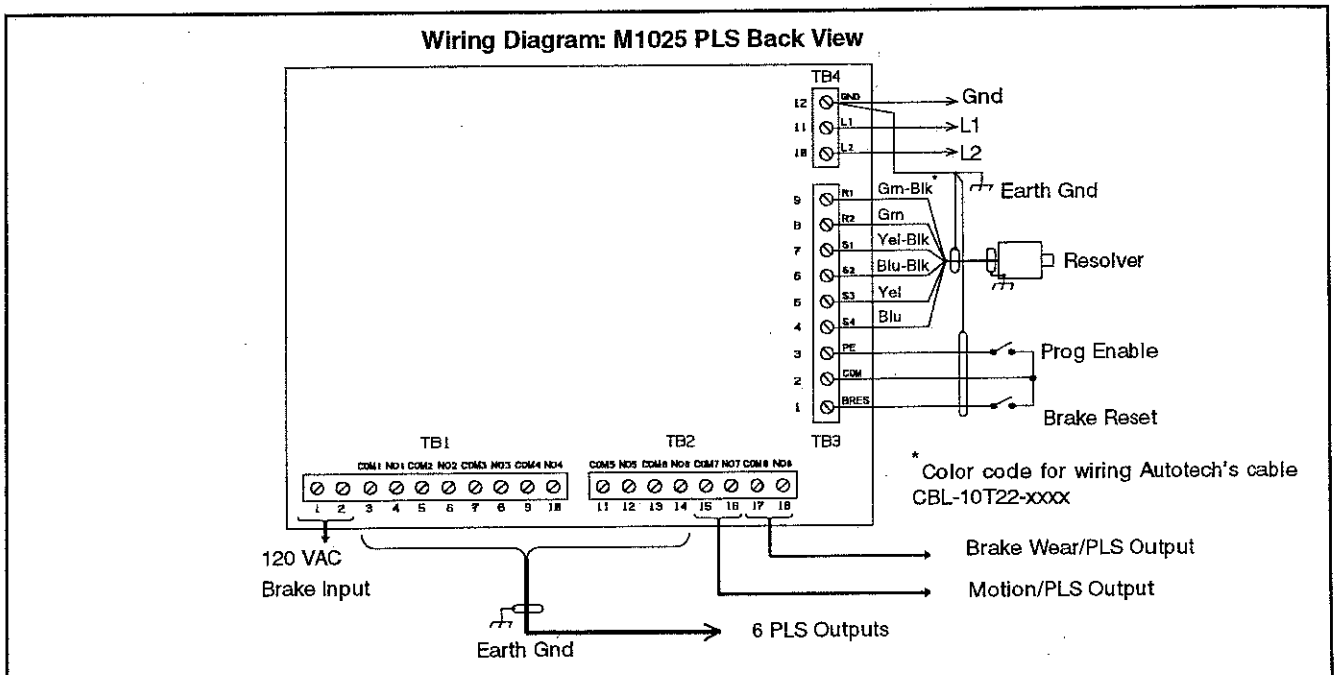
The M1025 PLS mounts in a 6.3"x 5.1" panel cutout and requires four mounting holes as shown in the Panel Cutout drawing below. The M1025 will fit in a 6 inches deep panel. Slide the M1025 through the panel opening with gasket and tighten the four # 8 mounting screws. Attach the pre-wired removable terminal blocks to complete the installation.

The M1020 Program Interface module, when needed, is plugged into M1025 PLS using two thumb screws provided on the interface module. See figure below.





3. Wiring.



Notes:

1. All connectors are removable.
2. Resolver shielded cable must consist of **twisted pairs**, and the twisted pairs must be wired as per wiring instructions. It is recommended that the resolver shielded cable be run in its own **separate** conduit.
3. All shielded cable must be kept at a minimum distance of 2 inches from all high voltage or inductive wiring.
4. All shielded cable must be kept at a minimum distance of 12 inches from all motor wiring controlled by AC or DC drives.

4. Programming M1025 PLS.

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

Mode	Display Window		Mode LEDs "ON"
	Left	*Right*	
Position	Blank	Position	Position
Tachometer/ Prod. Rate	Blank	RPM / Prod Rate	Tach
Production Rate Factor	P	Rate Factor	None
Offset Prog.	Blank	Position After Flashing Offset	Offset LED
Channel Select	Channel #	On Setpoint	None
On S.P. Prog.	Channel #	On Setpoint	On S.P.
Off S.P. Prog.	Channel #	Off Setpoint	Off S.P.
Brake Danger Limit	d	Danger Time (in sec)	None
Motion Limit	L	Motion Limit (in RPM)	None
Stopping Time	t	Stopping Time (in sec)	None

Before programming the unit, make sure that:

- Programming and Display Module is in place.
- AC Power is applied and the unit is operational.
- The Program Enable input is enabled (terminal 7 of the resolver terminal block is jumpered to terminal 8).

Note:

If programming is not enabled, and an attempt is made to program any of the parameters, the unit will return to the Position Mode. A Program Enable input is an important safeguard against anybody tampering with valid programs.

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

- Position Mode
- Tach Mode
- Offset Mode
- Channel Mode
- Brake Danger Limit Mode
- Motion Limit Mode
- Stopping Time Mode

The -> key is used to enter submodes, and **INC** & **DEC** keys are used to alter numeric values. Pressing of **MODE** key any time during programming, switches to the next mode.

Warning:

There is no "erase" key for programming errors. All limit/program changes take effect immediately. Always use caution when changing limit settings.

When in any programming mode, if the keyboard is not pressed during a 1 minute time-out period, the M1025 will return to the default Display Mode. This is to prevent the unit from being accidentally left in any programming mode for extended periods of time. If a time-out occurs while programming, simply use the **MODE** Key to return to the desired mode.

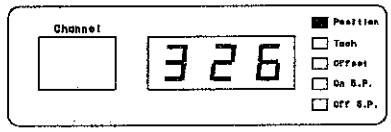
All values will be retained in the EEPROM memory indefinitely with or without power applied to the unit. The only item changed on loss of power is the current channel number which will default back to channel 1.

The following section is organized in the progression most often used when installing the M1025 PLS. Please note that numbers used below are for illustrative purposes only, and do not mean to show any specific default or standard values.

After power up, the unit will be in the Position display mode, Tach mode or Stopping time mode as previously selected by the user.

4.1 Position Display

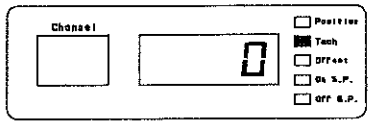
In Position mode, the display will appear as follows:



If the previous default mode was Tach, pressing Recall key will make Position a new default on power up.

4.2 Tach/Production Rate Display

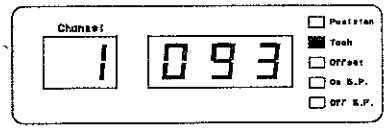
Press **MODE** key to switch to the Tach Display Mode. The display will be as follows:



The number in the display window will indicate Production rate. If production rate factor is 1 (default value—see section 4.3), the display is in RPM.

If previous default mode was Position, pressing Recall key in the Tach mode will make tach a new default.

If a tachometer reading exceeds 1000, the left window display is used to show the most significant tach digit.



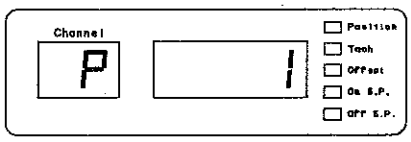
If a production rate factor has been programmed, the display shows production rate, instead of RPM.

4.3 Production Rate Factor Programming.

The M1025 has a capability of displaying approximate production rate in parts per minute. This value is displayed in the Tach mode when appropriate production rate factor has been programmed. The default value for a production rate factor is 1, resulting in the tach display of RPM (revolutions per minute). A production rate is calculated according to formula

Production Rate = (RPM) x (Parts per Revolution)

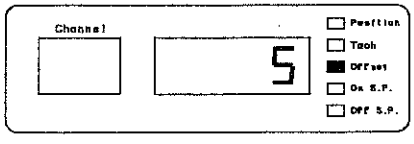
A production rate factor that needs to be programmed is really an estimated number of processed parts per one revolution of resolver.
In order to program the Production Rate Factor, an M1025 has to be in the Tach Mode. Press the **Arrow** Key. The display will change to:



Now use **INC** and **DEC** Keys to set Production Rate Factor to the desired value. The range for Production Rate Factor is 1 to 100. It will not be allowed to increment above 100.
Important Note:
The limit for the total Production Rate is 3999. It is user's responsibility to make sure that a product of Revolutions per minute and Parts per Revolution does not exceed 3999. Otherwise, the resulting Production Rate will be wrong.

4.4 Offset Programming.

From the Production Rate Factor Mode or Tach 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 a current offset value for about 2.5 seconds, and then returns to show current position.
(Current Position = Resolver Position + Offset).

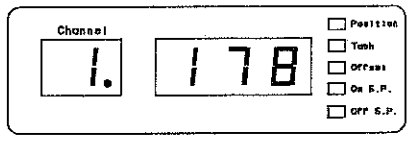


If programming is enabled, pressing the **INC** or **DEC** keys will increase or decrease this current value. An allowed offset range is from 0 to 359. If an attempt is made to increment position + offset above 359, it will roll over to 0. Similarly, if position + offset is decremented below 0, it will roll over to 359.

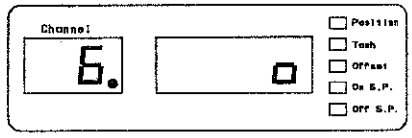
Warning:
It is not recommended that offset be programmed while machine is in motion. Even though the offset value is changing, it will not be apparent to the user because position + offset will be constantly updated.

4.5 Channel Selection.

Use the **MODE** Key to change from the Offset Mode to the Channel Mode. The left window will display the current selected channel number, and the right window will display the current from setpoint value.

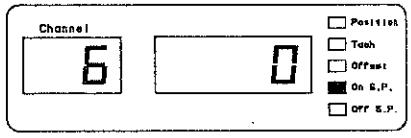


Note that all Mode indicator LEDs are off. The decimal point in the left window is blinking This means that only a channel number can be changed in this mode. Use **INC** and **DEC** keys to select desired channel.
If motion limit is set to zero, channel 7 can be used as regular PLS output. If brake danger limit is set to zero, channel 8 can be used as a regular PLS output. If either of these parameters is different from zero, the user will not be able to select a corresponding channel with INC or DEC keys.
When M1025 originally comes from the factory, no setpoints are programmed.
The following display is used to indicate that this particular channel has no setpoints. The "o" symbol is later referred to as a null setpoint.

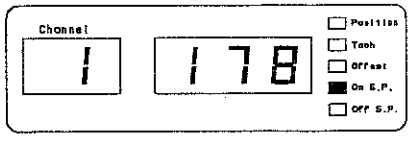


4.5.1 On Setpoint Programming.

While in the Channel Mode, press the Arrow Key(->) to enter an On Setpoint Mode. If a channel previously had no setpoints programmed, a null setpoint symbol will change to 0. **On SP** LED will also light up. The decimal point in the left window is extinguished.



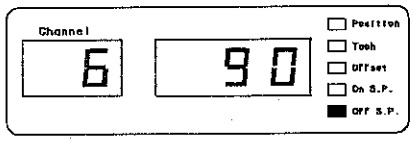
If a setpoint pair already exists, the display does not change from the Channel Mode display with an exception of **On SP** LED which goes on.



INC and **DEC** keys can now be used to program a desired On Setpoint value. Note, that if an on Setpoint being programmed was previously a null setpoint, an Off Setpoint will track an On Setpoint even though it may not be obvious to the user.

4.5.2 Off Setpoint Programming.

While in the On Setpoint Mode, pressing an Arrow key(->) will take a user into the Off Setpoint Mode. If there was no previous setpoint, an Off Setpoint value will be exactly the same as an On value. The **On SP LED is extinguished, however, and the Off SP** LED goes on instead. If a setpoint pair already exists for this channel, an existing Off Setpoint is recalled and displayed.

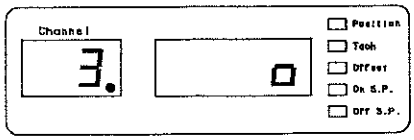


The displayed Off Setpoint value can now be incremented or decremented using **INC** or **DEC** keys to reach the desired value.

4.5.3 Removing a Setpoint Pair.

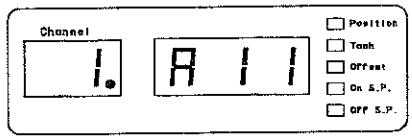
To remove a setpoint pair, first of all note the values of On and Off setpoints. Now the setpoint can be removed, using one of the following 3 ways. For illustrative purposes, assume that there exists a setpoint pair with On value of 35 and Off value of 70.

1. If in the On Setpoint Mode, the On Setpoint can be incremented until it is greater than or equal to Off Setpoint. For example, incrementing a 35 setpoint until it is greater than or equal to 70, will remove a setpoint pair.
2. Alternately, the On setpoint can be decremented until it is less than or equal to the Off Setpoint.
3. A third way to remove a setpoint pair is to enter the Off Setpoint Mode and to decrement it until it is equal to or less than an On Setpoint. For the example given above, if 70 is decremented to 35 or below 35, no setpoint will result. The next time the Channel Mode is entered, a null symbol will be displayed.



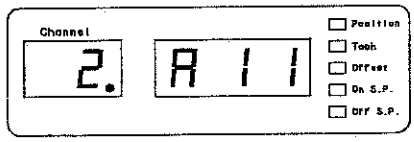
4.5.4 Turning a Channel Fully On.

The Off Setpoint must be incremented until it is equal to or greater than the On Setpoint. Use **Arrow** Key to exit from the Off Setpoint Mode and to enter the Channel Mode. "All" will appear in the right window.

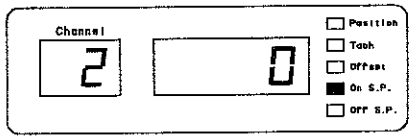


4.5.5 Reprogramming a Fully On Channel.

If it is decided to reprogram a fully on channel, the following steps must be used. Select a desired channel in the Channel Mode.



Use an **Arrow** key to enter the On Setpoint Mode. A 0 will be displayed instead of "All".



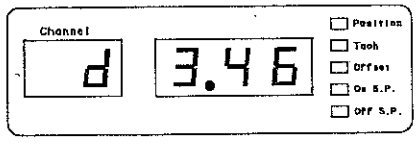
INC and **DEC** keys can now be used to program a new value in exactly the same way as if no setpoint existed before in this particular channel.

4.6 Brake Danger Limit Programming.

M1025 is equipped with Brake Wear Monitor. With brake wear monitor the user can view the stopping time of the machine, as well as control an output, called Brake wear output. The brake wear output is a fail safe relay output (normally energized). User program a danger limit. The brake wear output is de-energized if the stopping time is more than the programmed danger limit. The output can be reset by contact closure on brake reset input (term# 1 on TB3).

If brake danger limit is programmed to be zero, the brake wear output can be used as a normal PLS output (channel # 8).

From the channel mode, press the mode key to switch to Brake Danger Limit mode. The display will change to:



The unit of time in the right window is seconds. The **INC** and **DEC** keys can now be used to program Brake Danger time.

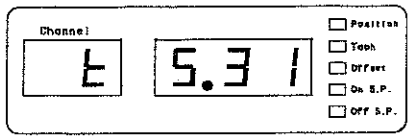
4.7 Motion Limit Programming.

From the Brake Danger Limit mode press the Mode key to reach Motion Limit Setting mode. The following display will appear:

Pressing the INC or DEC keys will alter the motion limit. The motion output (output 7) will turn on, if the shaft RPM exceeds the programmed motion limit.
If Motion limit is programmed as zero, the motion output can be used as a normal PLS output (channel # 7).

4.8 Viewing Stopping Time

Pressing the mode key in the motion limit mode will take the user into stopping time viewing mode. This mode is related to the brake wear monitor feature of the M1025. The user will be able to see the time in seconds, it takes for the shaft to stop from the moment the brake input is applied.



The brake reset can be applied to clear the display and reset the danger output. Alternately, the next brake input signal will clear the display and reset the output.
Stopping time can be made a default mode on power up by pressing **RECALL** key while in this mode.

How to Order

1. M1025 PLS

SAC-M1025-01 Basic unit for 8 outputs without relays and operator interface

Slave Units:

S: For a slave M1025 PLS change the "A" in SAC (in above part number to "S").

220/240 VAC units:

2: For 220/240 VAC, 50/60 Hz AC power input, change the "C" in SAC (in above part number to 2)

2. Operator Interface

ASY-M1025-POI Programming Operator Interface

3. Power Output Relays

Select the number and type of relays required.
Electromechanical and solid state relays can be mixed

KSD-A12DC-10A	EM relay, SPST, 120 VAC @ 10 Amps resistive load with adapter board
KSS-120AC-3AMP	AC solid state relay, 120 VAC @ 3 AMPS
KSS-60VDC-3AMP	DC solid state relay, 60 VDC @ 3 AMPS
KSS-200DC-1AMP	DC solid state relay, 200 VDC @ 1 AMP

4. Position Transducers

The M1025 requires Autotech's single-turn resolvers as input devices, such as RL100, RL101, RL500, RL501, E1R, E7R, E8R or E9R series of resolvers. Please see position transducer section of the Master Price List or Catalog for ordering information on these resolvers and appropriate accessories)

5. Enclosure

ENC-M1050-W16 NEMA 12 enclosure with window and built in security clamp

6. Accessories

MTP-M1020-0910 Front Cover Plate

7. Back Panel Mounting Brackets

MBK-M1050-011 Back Panel Mounting Brackets

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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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