AVG Automation

AUTOTECH CONTROLS

UTICOR

M1052 Programmable Limit Switch (PLS)

Instruction & Operation Manual

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

Factory Customer Service/Order Entry ▼
4140 Utica Ridge Rd.
Bettendorf, IA 52722
Tel: (319)359-7501
(800)711-5109
FAX: (319)359-9094

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

Vist our web site at: www.avg.net

MAN-M1052-PLS
REV 04 07/14/99

Table of Contents

Introduction

Introduction.....1

Specifications

Specifications.....2

How to Order

How to Order 3

Installation and Operation

1. M1052 Front Panel 4
2. M1052 Rear View, Terminal and Wiring).....5
3. Mounting.....6

Programming

Definitions 7
Key Functions.....7
Programming Flow Chart 8
1. Default Display.....9
2. Scale Factor.....9
3. Offset 9
4. Setpoint Programming.....9
5. End/Beginning of New Cycle Position 9
6. Speed Compensation 9
7. Enable Inputs 10
8. Analog Output Scaling 11
9. Duplication of Programs.....11
10. Motion Limits 11
11. Low Motion Enable 11
12. Program Number Selection.....11

Symbols Used in Programming Displays 12

Troubleshooting

M1052 Troubleshooting Guide.....13

Warranty

Warranty 14

M1052 PLS Glue Gun Controller

Instruction Manual

Introduction

Autotech's PLS and Mini-PLS families have continually set the standard for speed, precision, reliability, and product features in the Programmable Limit Switch marketplace. While retaining the key features and high standards of other Autotech products, the M1052 combines 16 PLS outputs, fault detection and indication, 16 user-defined PLS programs, and simple, easy-to-learn programming in one compact unit with a NEMA 12 front panel. In addition, each of the 16 PLS programs supports up to 120 ON/OFF setpoint pairs that may be used in any combination of 60 each on the low and high 8 channels. Included also are a fault output that indicates on the display the source of the fault for fast, easy troubleshooting and a motion detector that energizes when the resolver is rotating faster than programmable low limit.

Powerful, Easy to Learn, Man-Machine Interface

Autotech's human factors engineering has made it possible to program all PLS functions with only five front-panel keys and a smart front-panel display:

With these five self-explanatory programming keys, programming the M1052 is extremely simple — no long complex key sequences to remember.

Simultaneous Display of Related Parameters for Easy Understanding

In the normal operating mode, the large, .56" numerical display indicate the selected PLS program number, the current resolver RPM and shaft position. When programming PLS setpoints, the display shows the selected channel number and the selected ON and OFF setpoints.

In all modes, bright, easy-to-read bar graph displays show the true output status of all 16 PLS outputs as well as the fault relay status, the motion output status, and the external program select enable input status.

Speed Compensation for PLS Outputs

Separate leading (off to on) and lagging (on to off) speed compensation for channels 1 to 5; programmable in 1 ms increments.

Three Enable Inputs

These three enables are user programmable to be associated with any combination of channels 1 to 5.

Low Motion Enable

Programmable motion limit, disables associated glue gun outputs when the machine's RPM fall below this limit

Patented "↑ " and "↓" Keys for Fine Tuning in Motion

Set point and speed compensation program values can be adjusted with the machine running, making fine tuning of job parameters easy. Two fully isolated supervisory inputs prevent accidental or unauthorized program changes.

Multiple Program Storage Makes Job Changeover Easy

The M1052 PLS can store up to 16 independent, user-defined PLS programs for different machine setups. The M1052 is easily configured to accept either front-panel or external programmable controller compatible input to select a program.

The M1052 offers a duplication function, that duplicates a program's parameters to another program number. This allows fine tuning of only the necessary parameters, as opposed to re-entering all of the parameters.

Fully Isolated Inputs and Outputs

All M1052 inputs and outputs are fully isolated from user power sources to provide outstanding electrical noise immunity in harsh industrial environments.

Built-In Fault Detector

The Fault Output is normally energized when the M1052 PLS is operating normally and the resolver wiring is intact. If an internal M1052 fault is detected, or the power fails, or one or more of the resolver wires is broken or disconnected, the Fault output will de-energize. Under fault conditions all PLS outputs and the motion output will de-energize.

Built-In Tachometer and Motion Detector

The built in tachometer and motion detector are accurate to 1 RPM and are updated over 68 times per second to provide fast, accurate indication and detection of rotary motion. The motion detector is programmed to energize a power relay output when the machine's RPM is between the motion low and high limits. The motion detector output status is indicated on the front panel.

Specifications

Power Requirements:
105–135 VAC, 50/60 Hz, 20 W or
220–260 VAC, 50/60 Hz, 20 W (option)
Operating Temperature:
–10 to +130 °F (–23 to +55 °C)

PROGRAMMING
Number of PLS Programs:
16 selectable from keyboard or externally via 5 program selected inputs (PS0 – PS3 and EP)
PLS Setpoints:
120 per PLS Program (60 for Ch 1–8 and 60 for Ch 9–16) 1920 total
Scale Factor:
Programmable from 16 to 999, common to all PLS programs (resolution 17 to 1000 counts/turn)
Offset: Programmable from 0 to Scale Factor Value, common to all PLS programs
Speed Compensation:
Programmable leading and lagging speed compensation for channels 1 to 5. Each speed compensation is programmable in increments of 1 ms.
Motion Detector:
Low and High Motion Limits, common to all PLS programs, Programmable from 0 to 999 RPM
Low Motion Enable:
Low motion enable, common to channels 1–5 associated with enable inputs EN1, EN2, EN3. Programmable from 0 to 999
New Cycle Position:
Programmable from 0 to scale factor value. Common to channels 1–5 associated with enable inputs EN1, EN2, EN3.

RESOLVER INTERFACE
Position transducer:
Resolver, Autotech Series RL100, E6R, E7R, E8R, RL101 or equivalent
Cable Length between Resolver and M1052:
2500 feet max, shielded
Resolver Cable: Autotech CBL-10T22-XXXX
Maximum Resolver Shaft Speed: 3600 RPM
Resolver Decoder: Ratiometric

CONTROL INPUTS
Electrical specifications: (All Inputs)
Optical Isolation: 1500 V
Input impedance:1800 Ohms
Logic levels
TRUE: 1 to 28VDC sourcing
FALSE: 0 to 0.8 VDC
Enable EN1, EN2, EN3:
True enables selected channel (1 to 5). See section 8 on Enable Inputs for more details.

First Cycle Inputs (FCI) and Enable Inputs (EN1–EN3
Channels 1 to 5 can be individually associated with either of the enable inputs EN1 to EN3. This association is user programmable from the keypad. Any channel 1 to 5 with an enable (EN1–EN3) programmed into it, is also controlled by the first cycle input and the programmed new cycle position. See programming section for details.

Supervisory Inputs (Svp0 and Svp1):

Svp0	Svp1	Outputs	Function
F/T	F	Enabled	No programming
F	T	Disabled	All programmable parameters can be programmed and viewed
T	T	Enabled	Only PLS setpoints and speed compensation values can be programmed

External Program Number Select (EP) and Program Select Inputs (PS0—PS3):
When SVP1 and External Program Select (EP) are TRUE, the PLS program is instantaneously selected by program select inputs PS0, PS1, PS2 and PS3 according to table given below:

Program Select Inputs				*PLS program*
PS3	PS2	PS1	PS0	*Selected*
F	F	F	F	1
F	F	F	T	2
F	F	T	F	3
F	F	T	T	4
F	T	F	F	5
F	T	F	T	6
F	T	T	F	7
F	T	T	T	8
T	F	F	F	9
T	F	F	T	A (10)
T	F	T	F	b (11)
T	F	T	T	C (12)
T	T	F	F	d (13)
T	T	F	T	E (14)
T	T	T	F	F (15)
T	T	T	T	H (16)

T: TRUE F: FALSE

OUTPUTS

Unregulated Voltage Out (VO):
Current Limited, unregulated 12 VDC for use with M1052 inputs ONLY. ***Not*** for external sensor power.

Fault Output:
Detects resolver broken wire and M1052 internal faults)
EM relay (Form C) output; 10 Amp resistive max @ 120 VAC;
Without Fault: Relay remains energized ("Fail Safe")
With Fault: Relay de-energized

Motion Output:
EM relay (Form C) output; 10 Amp resistive max @ 120 VAC;
Relay energized whenever resolver RPM is between the motion low and high limits

PLS Outputs:
Number of PLS Outputs: 16,

Number of PLS Setpoints:
120 PLS setpoints per program; 1920 total for 16 programs. 60 for Ch 1–16

Types of Outputs:

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

B. Solid - State Relay
1. AC output: 120 VAC @ 3 A; ON time: <3ms after zero cross; OFF time: At zero cross; Leakage: 2.1 mA @ 120 VAC
2. DC output: Up to 60 VDC @ 3 A; ON time: 5 µs; OFF time: 35µs; Leakage: 0.29 mA @ 15 VDC
3. DC output: Up to 200 VDC @ 1 A; ON time: 15 ms

OFF timε:100µσ; Λεακαγε: < 0.01µA ≅ 30 ςΔX

How to Order

1. M1052 PLS

SAC- M1052-010	Basic unit combines 16 power outputs, fault detection and indication (*with* electromechanical relays); 8 PLS outputs (*without* relays).

2. Relay Output Chassis

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

**Note:*
For 220 VAC unit, change the "Y" to "2" and
For 240 VAC unit, change "y" to "4".

3. Power output relays

Select the number and type of relays required.

KSD-012DC-10A	EM relay, SPDT, 120VAC @ 10 Amps resistive
KSS-120AC-3AMP	Solid state relay, 120VAC @ 3Amps
KSS-60VDC-3AMP	Solid state relay, 60VDC @ 3 Amps
KSS-200DC-1AMP	Solid state relay, 200VDC @ 1 Amp

4. Plug-in-Modules

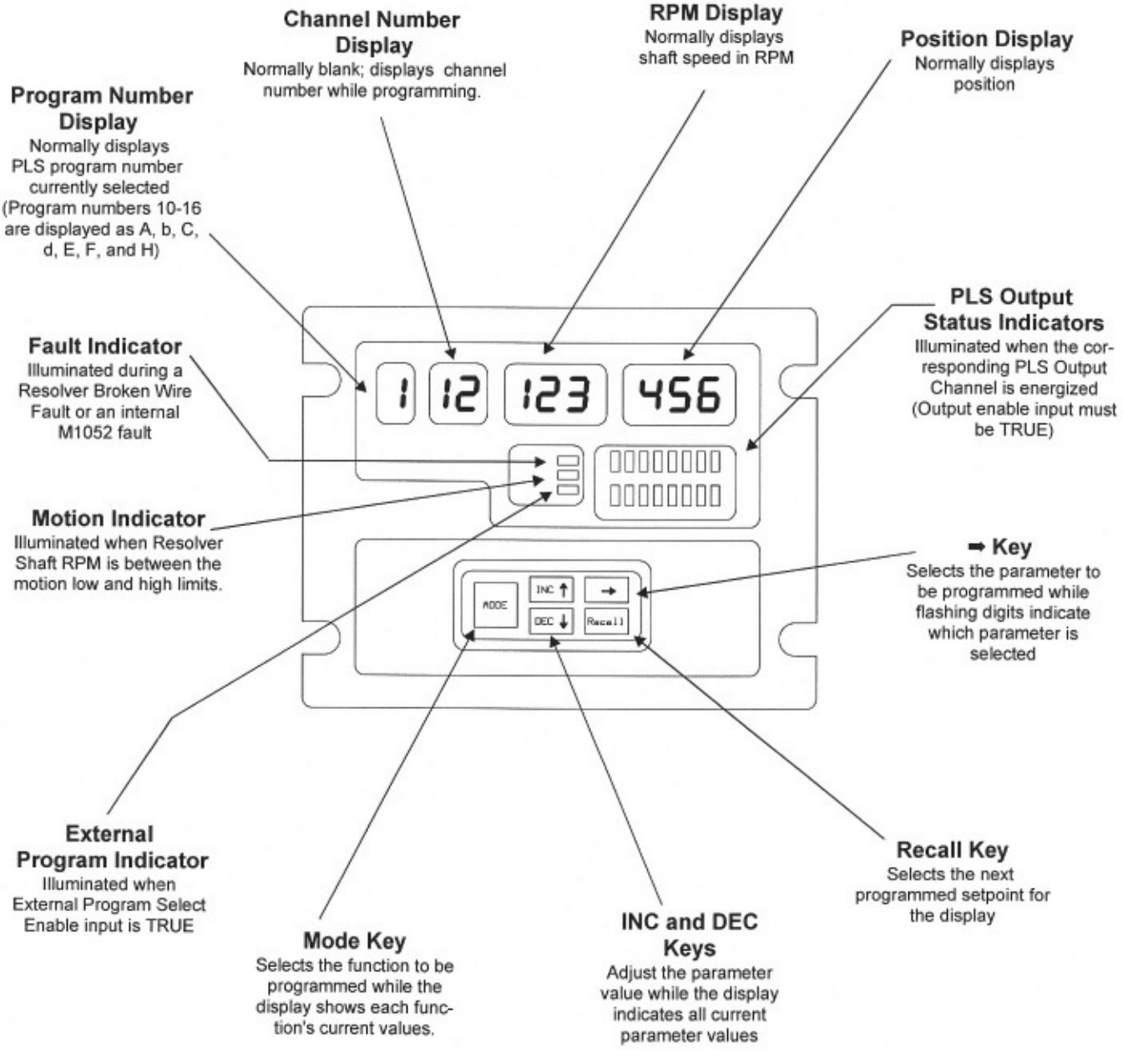
ASY-M1052-8P	Optically isolated PNP sourcing output module
ASY-M1052-8PTA	Above with the addition of 4-20mA analog velocity output

5. Position transducers

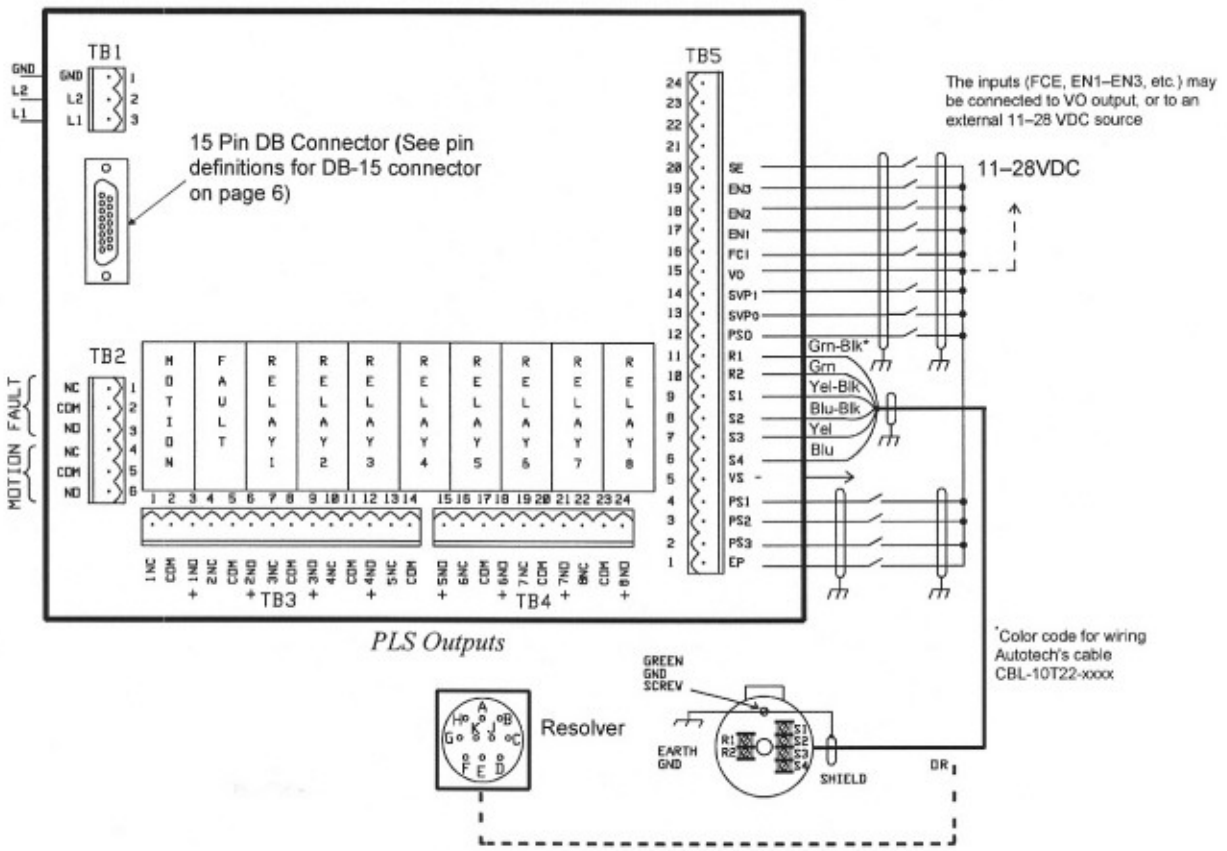
The M1052PLS requires a single turn resolver as an input device, such as Autotech's RL100, E6R, E7R or E8R series of resolvers. Please see rotary position transducer manual for How to Order information on these transducers and appropriate accessories.

Installation and Operation

1. M1052 Front Panel



2. M1052 Rear View, Terminals and Wiring



Logic I/O	Function/Description
VO	Unregulated, Current Limited 12VDC output (For use with M1052 inputs only)
R1–R2,S1–S4	Resolver input
VS–	Common terminal for Customers 11–28 VDC source
SE	Safety enable. True enables associated channels
EN1–EN3	Controlling enable inputs. True enables associated channels for that cycle
FCI	First cycle Enable. True enables associated channels for first cycle
Svp0–Svp1	Supervisory inputs (see table on page 2)
PS0–PS2	Program select inputs (see table on page 2)
EP	External PLS Program select enable Input. True enables external program number changes
NC	Normally Closed (Not connected for-solid state relays)
NO	Normally Open (Positive side for solid-state relays)
COM	Common

Resolver Wiring
CBL-10T22-xxxx Cable

Wire Color	*Resolver Terminal*	*Conn. Pin*
Green-Black	R1	F
Green Twisted pair	R2	E
Yellow-Black	S1	D
Yellow Twisted pair	S3	C
Blue-Black	S2	B
Blue Twisted pair	S4	A
Shield	Grn Gnd	G

Notes:

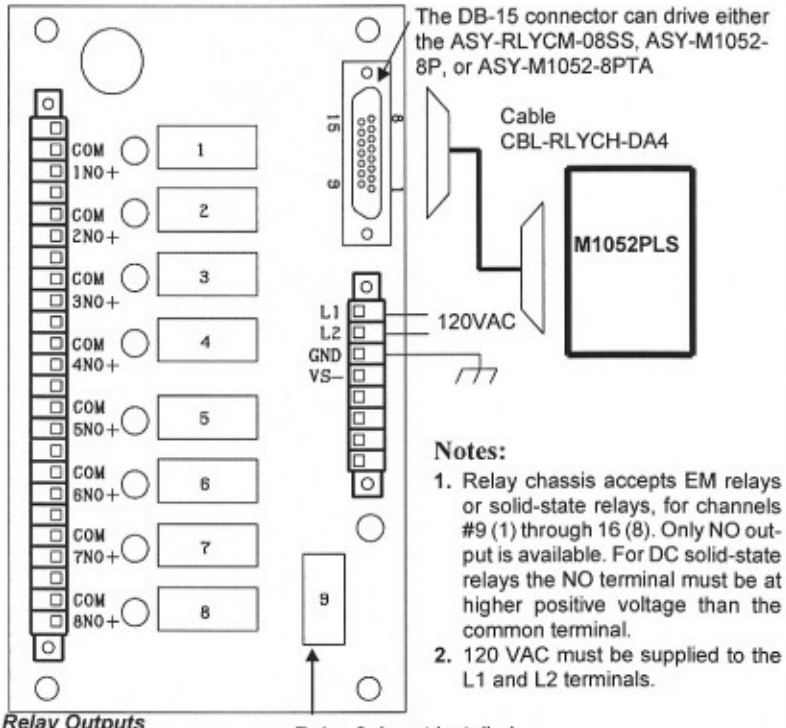
- Output wiring to other electronic devices such as programmable controllers must use uninterrupted runs of shielded cable with the shield connected to earth ground at both ends.
- No special tools are required to wire the M1052 PLS.
- Only NO output is available with solid state relays. For solid state relays, the NO terminal must be at a higher voltage than COM terminal.
- Use Autotech's overall foil shielded cables for wiring resolver. Following table gives wire colors of cable CBL-10T22-xxxxx used to wire resolver
- To change the resolver ascending count direction, reverse the S1 and S3 connections.

Pin definitions for DB-15 connector		
Pin #	**Cable color**	**Function**
1	Black	Tach Output Latch
2	White	Vs– (Sig Ref or Com)
3	Red	4.3 VDC
4	Green	Tach Output Data
5	Orange	Channel 15
6	Blue	Channel 13
7	White/Black	Channel 11
8	Red/Black	Channel 9
9	Green/Black	Vs–
10	Orange/Black	Unreg 12V out
11	Blue/Black	Tach Output Clock
12	Black/White	Channel 16
13	Red/White	Channel 14
14	Green/White	Channel 12
15	Blue/White	Channel 10

NC : Not Connected;
White/Black : White wire with Black stripes

Expansion Power Relay Output Chassis Wiring
(ASY-RLYCH-08SS)

8 Outputs Relay Chassis



Notes:

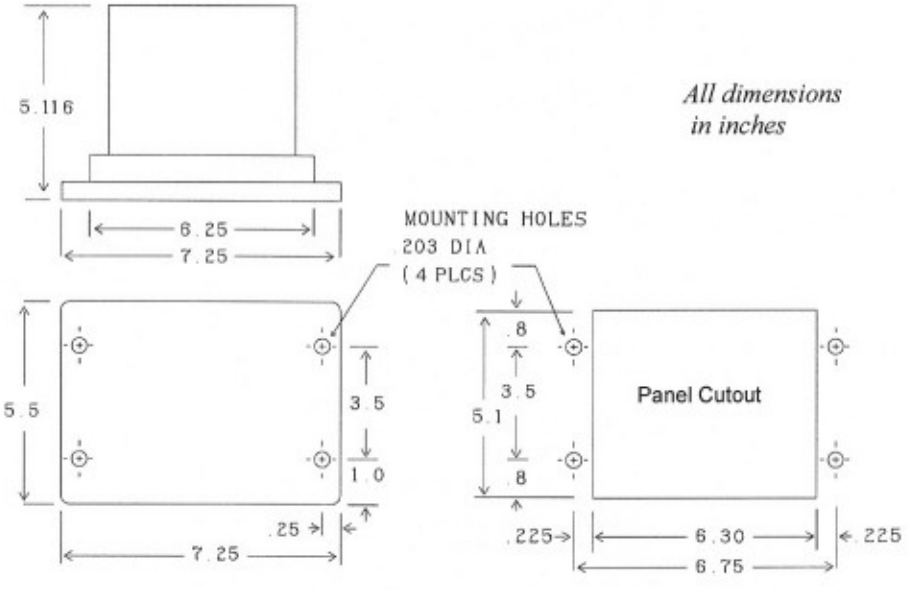
1. Relay chassis accepts EM relays or solid-state relays, for channels #9 (1) through 16 (8). Only NO output is available. For DC solid-state relays the NO terminal must be at higher positive voltage than the common terminal.
2. 120 VAC must be supplied to the L1 and L2 terminals.

Relay Outputs
NO: Normally Open
COM: Common

Relay 9 is not installed

3. Mounting

The M1052 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 M1052 will fit in a 6 inches deep panel. Slide the M1052 through the panel opening with gasket and tighten the four #8 mounting screws. Attach the pre-wired removable terminal blocks to complete the installation.



Programming the M1052 16 Channel PLS

The following is an overview of the programming modes on the M1052-16 Channel PLS. The different modes are accessed by repeatedly pressing the MODE key until the desired mode is displayed. More detailed description of the programming modes follow on the next page.

When inputs Svp0 = False and Svp1 = True, all programming modes are accessable. All outputs are disabled. All parameters can be programmed.

- **Default Display** — Program number, tachometer, and position are simultaneouly displayed.
- Scale Factor (16 to 999)
- Offset (0 to scale factor)
- PLS Set Points (0 to scale factor)
- New Cycle Reset (0 to scale factor)
- Speed Compensation (0.000 to 0.900 msec)
- Enable association for channels 1 to 5
- Analog scaling 4.0 to 20.0 mA and 0 to 999 RPM
- Program Duplication
- High and Low Motion Limits (0 to 999)
- Low Motion Enable (0 to 999)
- **Program number selection from keyboard**— the program number is changed by direct keyboard selection, if the external program selection (EP) is true. The program number is controlled by input PS0- PS3 and the program number mode is not accessable.

Note:
Programming of the analog output scaling is only necessary when the optional analog/digital board is plugged into the M1052.

When inputs Svp0 = True and Svp1 = True only, the following three modes are displayed. All outputs are enabled. Setpoints and speed compensation can be programmed.

- Default Display
- PLS Setpoints
- Speed Compensation

When input Svp0 = True/False and Svp1 = False, only the default mode is displayed. All programming is disabled.

The M1052 will automatically return to the default display mode if left without any key presses for more than one minute.

Note:
1. See Flow Chart on the next page.
2. See Symbols used on page 12.

Definitions

Program
There are sixteen distinct setups which may be preprogrammed into the M1052. These setups are identified by a Program Number 1 to H. The current Program Number may be selected in two ways:

1. External Program Selection, if EP enabled.
2. Keyboard Program Number Selection, if EP disabled.

The following parameters are independant of Program Number and are common to all programs:

- Scale Factor
- Offset
- High/Low Motion Limits
- End/Beginning of new cycle
- Enable Inputs association
- Analog output scaling
- Low Motion Enable

The remainder may have different values from program to program. There are 16 independant output channels, each of which contains it's own setpoint program to turn the output on or off at different shaft angles. Channels 1 to 5 also contain their own speed compensation factors

Key Functions

The programming key sequences are fairly general for all modes. The keys function as follows:

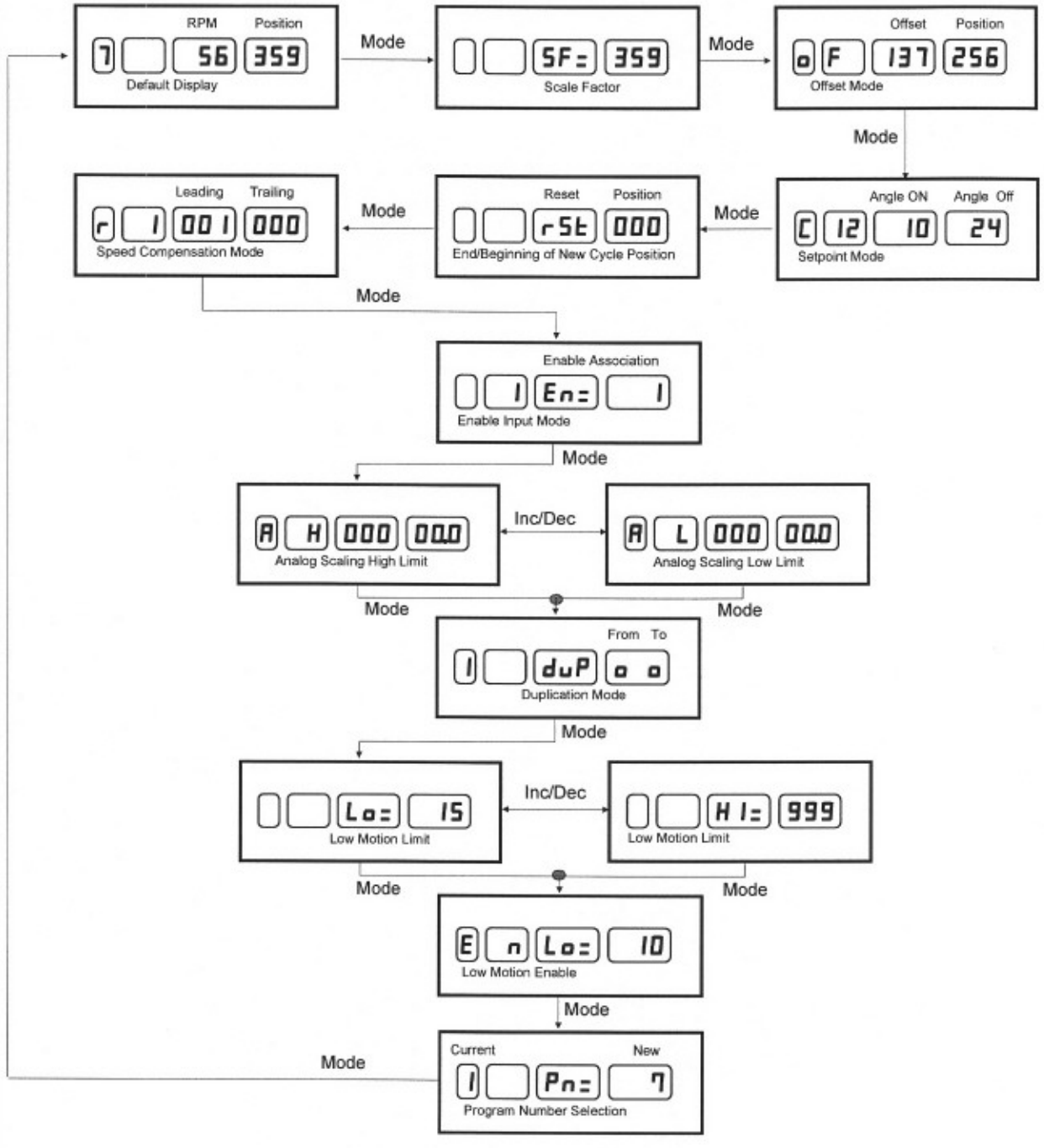
MODE Key:
Press to sequence through the different programming modes. Pressing the MODE Key will save programming changes to the nonvolatile memory.

INC / DEC Keys:
Blinking digits in a window indicate that that window's contents may be changed; numbers will be incremented or decremented, non-numerical selections will change to other selections. Channel Number in the second window can always be increased and decreased.

Right Arrow Key:
If programming is enabled, use the Right Arrow Key to change which window may be edited. Editing may occur in the window with the blinking digits.

Recall Key:
The Recall Key is used to recall setpoints in Channel Setpoint mode. It is also used to perform programming duplication in the duplication mode.

Programming Flow Chart



SVP0	*SVP1*	*Modes Available*
F/T	F	Default display only
F	T	All modes
T	T	Default display, setpoint and speed compensation

1. Default Display

Program Number, Tachometer RPM, Base Position.

In the event of a resolver cable fault:
Program Number, and the message "CABLE" instead of Tach and Position.

The Base Position for the M1052 is composed of the absolute resolver position plus the machine offset value which is common to all sixteen programs.

2. Scale Factor

Svp0=False and Svp1=True for programming and viewing

The Scale Factor is the desired counts per turn minus one. For example, to work in degrees, program the Scale Factor to 359. The allowed range of values is 16 to 999. The Scale Factor is common to all Programs 1 to H.

3. Offset

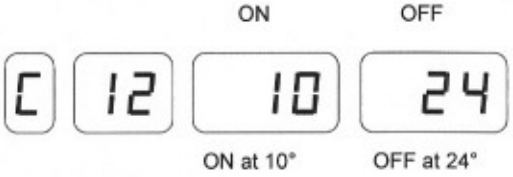
Svp0=False and Svp1=True for programming and viewing

The Offset value is the angle that when added to the absolute resolver postion, yields the desired machine position. The allowed range for the offset is 0 to Scale Factor. The Base Offset is common to all Programs 1 to H.

4. Setpoint Programming

Svp1=True for programming and viewing

Angle-on/Angle-off setpoints are programmed in this mode.



When the Shaft is moving in the forward direction (CCW), Angle-on/Angle-off setpoints are defined as: Angle-on = Angle at which the output will turn on. Angle-off = Angle at which the output will turn off. These angles are programmed by using the Right Arrow Key to select the number to edit, then Incrementing or Decrementing the number. Pressing the Right Arrow Key moves you from Channel Number to On Setpoint to Off Setpoint to both On and Off setpoints together, and back to Channel Number. Pressing the Recall Key will reveal any additional Setpoints in the selected channel and will provide the "Null Setpoint" symbol [o][o] so that additional setpoints may be added to that channel. Each Channel 1 to 16 may contain any number of setpoints (on/off pairs) up to the following limits: 60 setpoints channels 1 to 16.

5. End/Beginning of New Cycle Position

Svp0=False and Svp1=True for programming and viewing

Use the **INC** and **DEC Keys** to change the reset position. When the resolver reaches this position, the M1052 resets the output channels associated with the enable inputs EN1–EN3.

6. Speed Compensation

Svp1=True for programming and viewing

Each channel from 1 to 5 has its own pair of speed compensations. The value in the RPM window is the leading speed compensation, and the trailing speed compensation is in the position window in msec. The right **Arrow Key** moves you from channel to leading to trailing values. The values are

changed using the **INC** and **Dec Keys**. The trailing speed compensation is always less than or equal to the leading speed compensation. The Mode Key advances to the next page. The speed compensation values displayed are in msec.

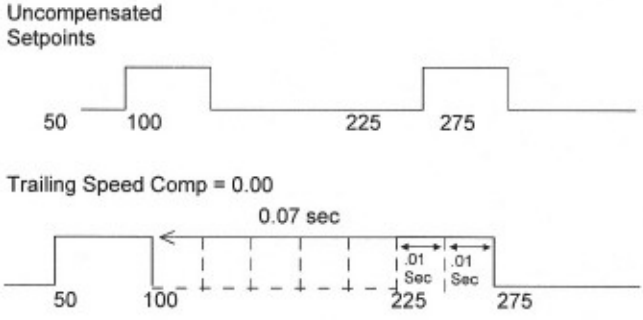
Note:

Caution must be used in programming the speed compensations. Since the leading speed compensation can be much larger than the trailing speed compensation, it is possible to have a setpoint leading edge colide with the trailing edge of itself or the previous setpoint. This situation is RPM dependant. What works at low RPM might not work at a higher RPM.

Example:

Scale Factor = 360

(360 Degree/Rev) (RPM) (Min/60 Sec) = (Deg/Sec)

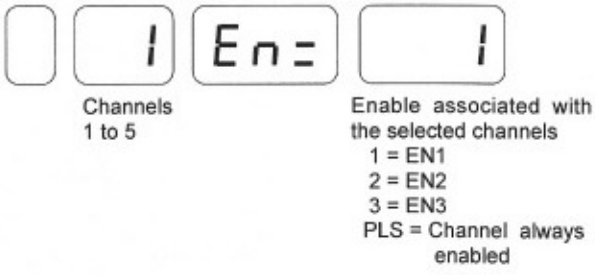


@ 417 RPM 360 * 417 *1/16 =2500 Deg/Sec

At 417 RPM with the leading speed compensation set to 070 (.07) sec and the trailing speed compensation set 000, the above setpoints collide with each other. These speed compensation and/or setpoint values will not function correctly at any RPM faster than 417.

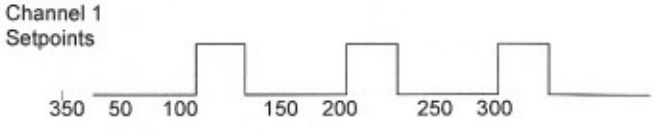
7. Enable Inputs:

Svp0=False and Svp1=True for programming and viewing



Enables EN1, EN2 and EN3 are user assignable to channels 1 to 5. These enable inputs are read during the period between the new cycle position and the next setpoint position for that channel. If a true level is read then the channel associated with that input is enabled for that cycle.

Example SF=359, EN=3
New Cycle Position=350

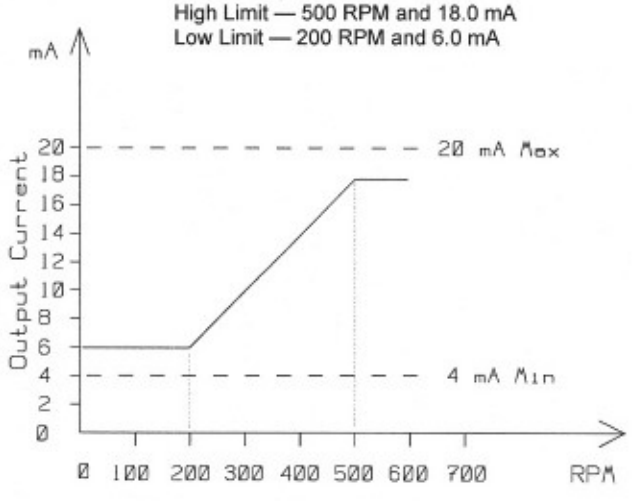


If EN3 is high at any point between positions 350 and 50, channel 1 is enabled for that cycle. If not channel 1 is disabled for that cycle. If the channel association is PLS, the corresponding channel is always enabled, independant of the EN1–EN3 inputs (functions as normal PLS). The FCI input controls the channels (1 to 5) associated with any enable. For these channels to be active during the first cycle (one revolution after the resolver is stopped), the FCI has to be true.

8. Analog Output Scaling

Svp0=False and Svp1=True for programming and viewing
The **Inc** and **Dec Keys** toggle from L (low) to H (High) limits. Enter the RPM limit and the corresponding current at that limit. The output current will act as depicted in the graph below.

The Analog Output is 4 to 20 mA. The minimum value for low limit current is 4 mA. The maximum value for the high limit current is 20 mA.



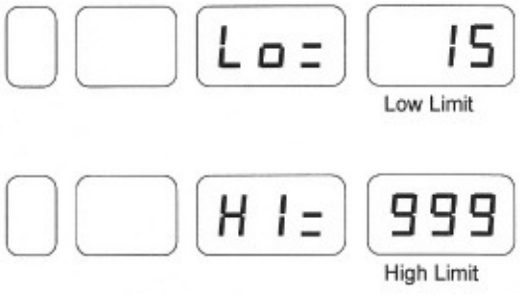
9. Duplication of Programs

Svp0=False and Svp1=True for programming and viewing

The current program number is displayed in the program number window. The program numbers to duplicate from and to are displayed in the position window. The **INC** and **DEC Arrows** toggle between the from and to program numbers in the position window. Pressing the **Recall Key** will duplicate the from program parameters into the to program parameters. The current to program parameters are lost, they are replaced with the duplicated values. The duplication is complete when a Null "0" appears in to window.

10. Motion Limit

Svp0=False and Svp1=True for programming and viewing
The motion output is controlled by the low and high motion limits.



If the resolver shaft RPM is between the motion limits inclusively, the motion output will be enegized. Motion limits are common for all 16 programs.

11. Low Motion Enable

Svp0=False and Svp1=True for programing and viewing

If the shaft RPM is greater than the low motion enable value, the channels 1–5 associated with any EN1, EN2, EN3 are enabled. When the RPM is less, these associated channels are disabled.

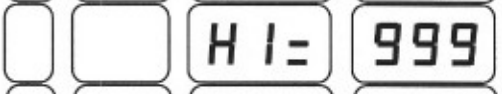
12. Program Number Selection

Svp0=False and Svp1=True for programming and viewing
Program Number Selection is allowed only if the following conditions are met:

- The shaft is not turning (RPM < 4),
- The Program Enable is on.

The Program Number may be selected from the keyboard only if the External Program Select input is off. If the External Program Select input is on, then the states of the Program Select inputs will determine which Program is selected.

Symbols Used in Programming Displays

Symbol	English	Function/Description
	CABLE	Cable fault
	SF	Scale factor
	Lo	Low motion limit
	HI	High Motion Limit
	EnLo	Low Motion Enable
	Pn	Program number
	C	Channel dwells, Ch 1–16
	r	Rate (speed comp) leading and lagging
	En	Enable select for Ch 1–5
	rSt	Cycle reset position, Ch 1–5
	A	Analog scaling
	H	High (L–Low)
	duP	Program duplication

M1052 Troubleshooting Guide

Symptoms	Possible causes
Unable to program unit parameters (Scale Factor, Offset, etc.)	• Is the Program Enable Input Svp1? (i.e., the voltage level at the input is less than 11V) • Is the machine moving? — programming of several parameters (Scale Factor, Program Number) is disabled if the resolver is turning faster than 3 RPM. • If unable to program setpoints, the PLS program may already have 60 setpoints.
Program memory is changing by itself.	• Has the program number been changed to a different number (P1-P16)? • Have proper grounding and shielding practices been applied? • Is the Svp1 input 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 RPM readings are incorrect.	• Is the resolver correctly wired? Follow the steps below for a quick check. 1. Turn power off to M1052 unit 2. With main terminal block removed from unit, measure with ohm meter the followings: A. Term. 5 to Term. 6 (R1 to R2) = about 30 ohms B. Term. 1 to Term. 3 (S1 to S3) = about 55 ohms C. Term. 2 to Term. 4 (S2 to S4) = about 55 ohms • Is the resolver cable properly grounded and shielded?
Mechanical Zero drifts.	• Is the mechanical Resolver linkage loose? • Has the offset value been changed?
If all fails	• Call AVG Technical Support at 1 (800) TEC-ENGR (832-3647)

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.

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

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

CAUTION

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

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

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