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Automation
aC AUTOTECH CONTROLS **UTICOR**

M1051 Programmable Limit Switch (PLS)

Instruction & Operation Manual

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M1051 PLS

1. 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 M1051 combines 16 power outputs, fault detection and indication, eight 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 eight PLS programs supports up to 160 ON/OFF setpoint pairs which may be used in any combination of 80 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 between motion limits.

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 the five self-explanatory programming keys, programming the M1051 is extremely simple — there are 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 indicates 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 eight PLS outputs as well as the fault relay status, the motion output status, and the external program select enable input status.

Individual Speed Compensation for all 16 PLS Outputs

The M1051 PLS features a rate offset to compensate for speed variations. This rate offset represents a positive number that varies linearly with RPM. The rate offset is added to the resolver position and is used to advance the PLS

settings as a function of the machine speed. In M1051, the rate offset can be programmed in scale factor units per 100 rpm up to full scale factor value.

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

Most programmed 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 M1051 PLS can store up to eight independent, user-efined PLS programs for different machine setups. The M1051 is easily configured to accept either front-panel or external programmable controller compatible input to select a program.

Fully Isolated Inputs and Outputs

All M1051 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 M1051 PLS is operating normally and the resolver wiring is intact. If an internal M1051 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.

2. Specifications

Power Requirements:
105–135 VAC, 50/60 Hz, 20 W or
220–260 VAC, 50/60Hz, 20 W (option)

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

PROGRAMMING

Number of PLS Programs:
8 selectable from keyboard or externally via 3 program selected inputs (PS0 015–PS2)

PLS Setpoints:
160 per PLS Program, 1280 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 in scale factor units per 100 rpm, up to full scale factor value. Each PLS channel has its own speed compensation. Channels 1–4 have 16 speed compensation zones.

Motion Detector:
Low and High Motion Limits, common to all PLS programs. Programmable from 0 to 999 RPM

RESOLVER INTERFACE

Position transducer:
Resolver, Autotech Series RL100, E6R, E7R, E8R, RL101 or equivalent

Cable Length between Resolver and M1051:
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 0.8VDC

Program Enable (PE):
When TRUE, enables setpoint programming, and (if EP input is also TRUE) External Program Number Select

Program Enable 2 (PE2):
When TRUE, enables setpoint and setup (scale factor, offset, program #, etc.)

Output Enable (OE):
When TRUE, PLS Channel outputs enabled (both Fault and Motion always enabled)

Fault Check Enable (FCE):
When TRUE, disables PLS and Motion Detector Outputs whenever Resolver Broken Wire Fault or M1051 internal fault occurs.

External Program Number Select (EP) and program select inputs (PS0–PS2):
When External Program Number Select input (EP) and Program Enable are both TRUE, the PLS program is instantaneously selected by Program Select inputs PS0, PS1, and PS2, according to table given below:

| Program Select Inputs | | | PLS Program |
PS0	PS1	PS2	Selected
F	F	F	1
T	F	F	2
F	T	F	3
T	T	F	4
F	F	T	5
T	F	T	6
F	T	T	7
T	T	T	8

T: TRUE   F: FALSE

OUTPUTS

Unregulated Voltage Out (VO):
Current Limited, unregulated 12VDC for use with M1051 inputs ONLY. *Not* for external sensor power.

Fault Output:
Detects resolver broken wire and M1051 internal faults)
EM relay (Form C) output; 10 Amp resistive max @ 120 VAC;
Without Fault: Relay remains energized
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 programmed motion limits.

PLS outputs:
Number of PLS Outputs: 16,

Number of PLS Setpoints:
160 PLS setpoints per program; 1280 total for 8 programs. 80 for Ch 1—8 , 80 for Ch 9–16
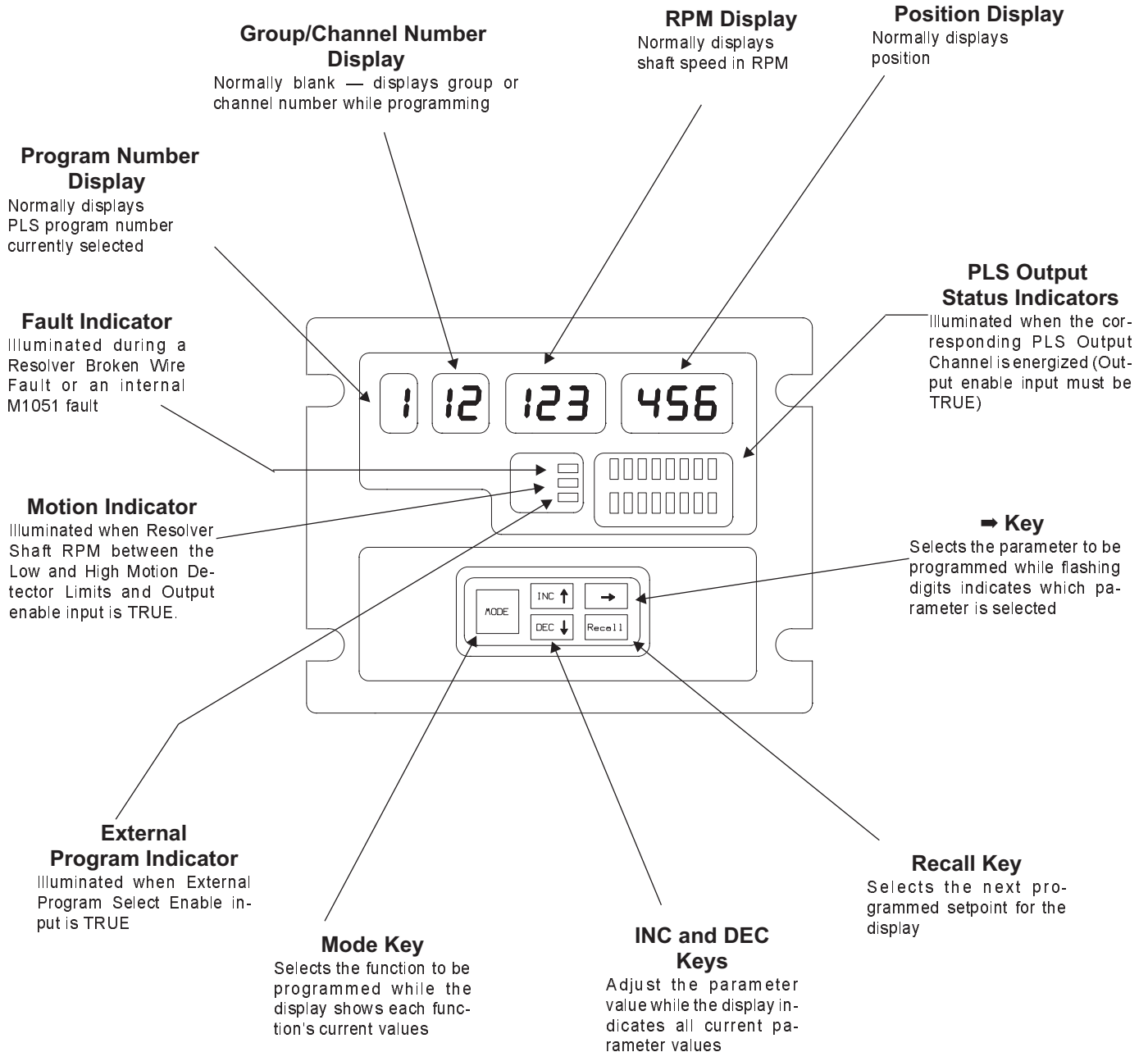
Types of Outputs:
A. Electromechanical Relay , 120 VAC
1. **KSD-A12DC-10A —** 10 Amp resistive, SPST
2. **KSD-012DC-10A** — 10 Amp resistive, SPDT
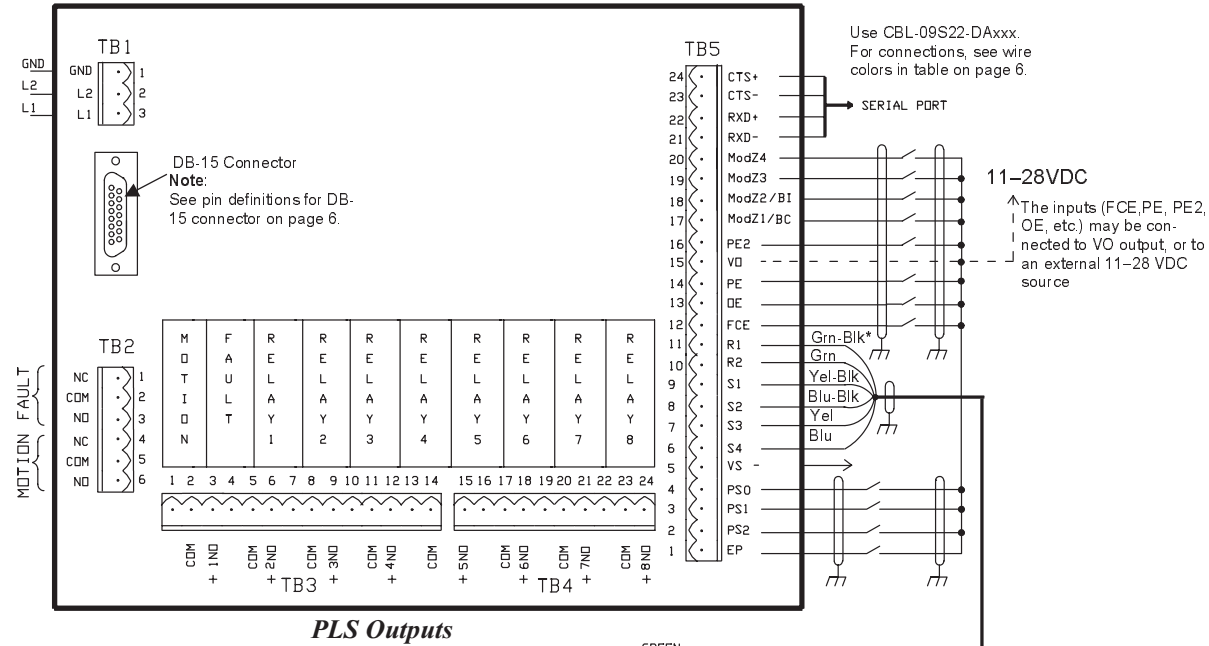B. Solid-State Relay
1. AC output: 120 VAC @ 3 A; ON time: <3ms after zero cross; OFF time: At zero cross; Leakage: 2.1mA @ 120 VAC
2. DC output: Up to 60 VDC @ 3 A; ON time: 5 μs; OFF time: 35 μs; Leakage: 0.29 mA @ 15 VDC
3. DC output: Up to 200 VDC @ 1 A; ON time: 15 μs OFF time: 100 μs; Leakage: < 0.01mA @ 30 VDC

3. Installation and Operation

M1051 Front Panel

Group/Channel Number Display
Normally blank — displays group or channel number while programming

RPM Display
Normally displays shaft speed in RPM

Position Display
Normally displays position

Program Number Display
Normally displays PLS program number currently selected

PLS Output Status Indicators
Illuminated when the corresponding PLS Output Channel is energized (Output enable input must be TRUE)

Fault Indicator
Illuminated during a Resolver Broken Wire Fault or an internal M1051 fault

Motion Indicator
Illuminated when Resolver Shaft RPM between the Low and High Motion Detector Limits and Output enable input is TRUE.

➡ Key
Selects the parameter to be programmed while flashing digits indicates which parameter is selected

External Program Indicator
Illuminated when External Program Select Enable input is TRUE

Recall Key
Selects the next programmed setpoint for the display

Mode Key
Selects the function to be programmed while the display shows each function's current values

INC and DEC Keys
Adjust the parameter value while the display indicates all current parameter values

M1051 Rear View, Terminals and Wiring

PLS Outputs

Use CBL-09S22-DAxxx. For connections, see wire colors in table on page 6.

The inputs (FCE, PE, PE2, OE, etc.) may be connected to VO output, or to an external 11–28 VDC source

Pinout and color code are shown on Page 6.

Notes for TB2, TB3 & TB4

NC	Normally Closed
NO	Normally Open (Positive side for DC solid-state relays)
COM	Common

INPUTS on TB5

Term#	Designation	Function/Description
1	**EP**	External PLS Program select enable Input
2-4	**PS2–PS0**	External Program select inputs
5	**VS-**	Common terminal for VO terminal or Customers 11–28 VDC external source for inputs
6-9	**S4–S1**	Resolver input (Stators)
10-11	**R2–R1**	Resolver input (Rotor)
12	**FCE**	Fault Check Enable
13	**OE**	Output Enable Input
14	**PE**	Program Enable Input
15	**VO**	Unregulated, Current Limited 12VDC output (For use with M1051 inputs only)
16	**PE2**	Master Program enable
17	**ModZ1/BC**	ModZ trigger input for Group1/Brake clear input
18	**ModZ2/BI**	ModZ trigger input for Group2/Brake wear input
19-20	**ModZ3 & 4**	ModZ trigger inputs for groups 3 & 4
21-22	**RXD- & RXD+**	Receive/Transmit data lines for RS485 serial port
23-24	**CTS- & CTS+**	CTS/RTS Hand shake lines for RS485 serial port
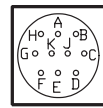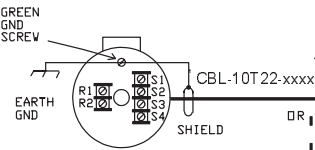
Brake Output Conditions

| Condition	Output 7 (Caution)	Output 8 (Danger)
Safe	0	1
Caution	1	1
Danger	1	0
0: OFF (De-energized) 1: ON (Energized)		

Notes:

- 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 M1051 PLS.
- Use Autotech's overall foil shielded cables for wiring resolver. See table, page 6, for wire colors of cable CBL-10T22-xxxxx used to wire resolver
- Slave M1051 is different than Master M1051 unit. Wiring to the slave unit is common only to the 120VAC input (L1, L2, GND) and the resolver: S4 to S4, S3 to S3, S1 to S1, R2 to R2 and R1 to R1. Up to 7 units may be slaved to a master and master and slave units may be any combination of the units.

Expansion Power Relay Output Chassis Wiring

8 Outputs Relay Chassis (ASY-RLYCH-08SS)

Relay Outputs
NO: Normally Open
COM: Common
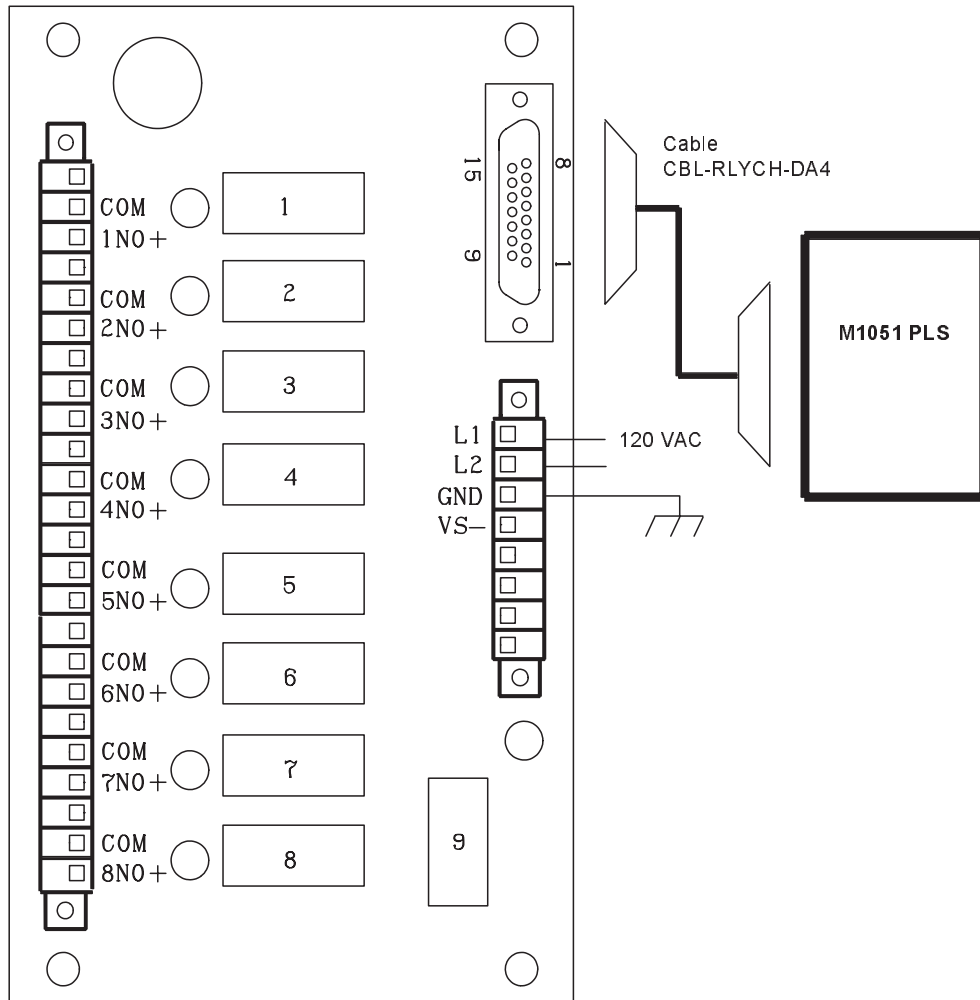
Notes:
1. The Solid-State Relay chassis shown above accepts EM relays (KSD-A12) or solid-state relays for channels #9 (1) through 16 (8). Only NOoutput is available. For DC solid-state relays the NO terminal must be at higher positive voltage than the common terminal.
2. Output #9 and output enable are not active with the M1051.
3. 120VAC must be supplied to the L1 and L2 terminals.
4. With ASY-RLYCH-08RL using KSD-012, NC relays are available.

Pin Definitions for DB-15 Connector	
Pin #	Function
1	NC
2	Vs– (Sig ref or Com)
3	Vs+ (50 VDC max for P & N; 5 VDC max for T)
4	NC
5	Channel 15
6	Channel 13
7	Channel 11
8	Channel 9
9	Vs–
10	Vs+
11	NC
12	Channel 16
13	Channel 14
14	Channel 12
15	Channel 10
NC: Not Connected	

Serial Port Wiring CBL-09S22-DAxxx Cable

Wire Color	M1051 Terminal	Conn. Pin
Blue-Black White	CTS+	8 6
Red-Black Yellow	CTS–	7 5
White-Black	RXD+	4
Yellow-Black	RXD–	3
Red	Gnd	9

Resolver Wiring — CBL 10T22-xxx Cable		
Wire Color (twisted pairs)	Resolver Terminal	Connector Pin
Green-Black	R1	F
Green	R2	E
Yellow-Black	S1	D
Yellow	S3	C
Blue-Black	S2	B
Blue	S4	A
Shield	Grn GND	G
To change the resolver ascending count direction, reverse S1 and S3 connections.		

Mounting

The M1051 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 M1051 will fit in a 6 inches deep panel. Slide the M1051 through the panel opening with gasket and tighten the four #8 mounting screws. Attach the pre-wired removable terminal blocks to complete the installation.

All dimensions in inches
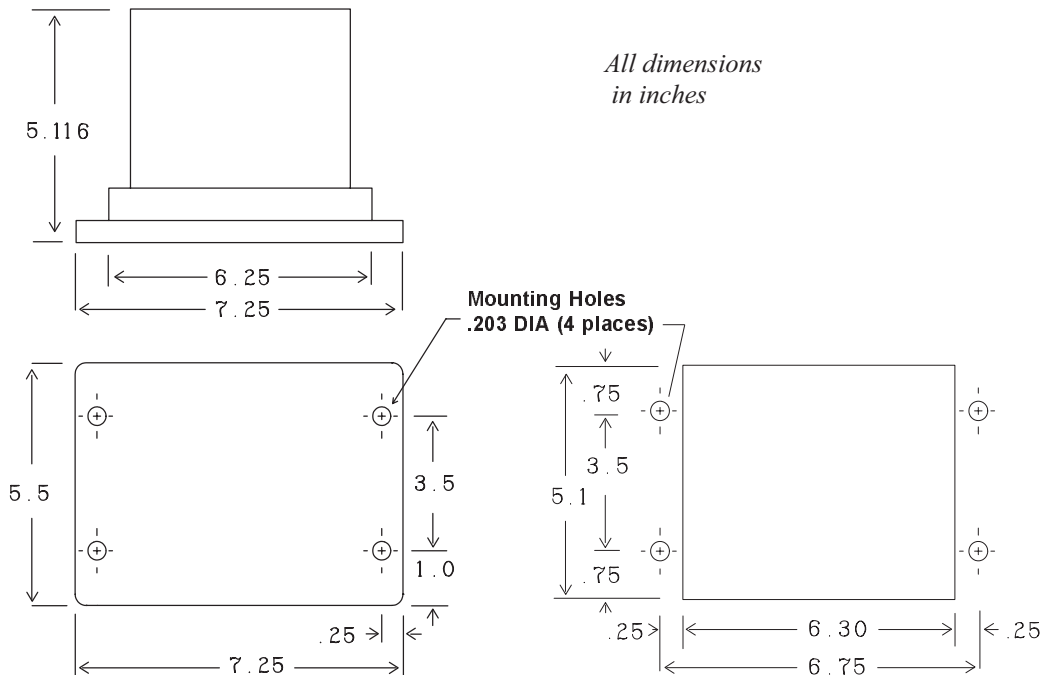
4. Programming the M1051 16 Channel PLS

Overview

The following is an overview of the programming modes on the M1051 - 16 Channel PLS. The different modes are accessed by repeatedly pressing the MODE Key until the desired mode is displayed. The M1051 will automatically return to the Default Display mode if left in some other mode for more than one minute without any key presses.

- Default Display: Program Number, Tachometer, Position or Brake Stop Time.
- Scale Factor
- Base Offset
- Group Types
- Group Assignments
- Channel Types
- Speed Compensation
- Brake Limits
- Motion Limits
- Program Number Selection from keyboard
- Station Number Selection for serial communications
- Baud Rate Selection for serial communications
- Setpoint Programming (direct access by pressing [Recall or Mode] from Default mode) - back to the Default Display

Note:
Both program enable inputs, PE + PE2, must be true to allow viewing or programming of any modes except the default mode and the setpoint mode.

Definitions

Program

There are eight distinct setups which may be preprogrammed into the M1051. These setups are identified by a Program Number from 1 to 8. The current Program Number may be selected in any of three ways:

1. External Program Selection. If enabled, the following two ways are disabled.
2. Keyboard Program Number Selection, and
3. Serial Program Number Selection.

The following parameters are independent of Program Number:

    Scale Factor
    Base Offset
    Motion Limits, High and Low
    Station Number for serial
    Baud Rate for serial

The remainder may have different values from program to program.

Group

Output channels may be "associated" or grouped together into one of four extra, independent groups. The base group is always PLS (Normal Programmable Limit Switch) type, while the groups 1–4 may be defined as PLS or ModZ type. Each PLS group has its own group offset while each ModZ group has its own ModZ input and a ModZ inhibit Zone. This creates the effect of having 5 independent M1051s running from the same resolver. This can be a very powerful and useful feature when it is desirable to control several different types of processes all being driven by the same shaft.

Channel

There are 16 independent output channels, each containing its own Setpoint program to turn the output ON or OFF at different shaft angles. Each channel also contains its own speed compensation factor so that propagation delays from output to process may be compensated for. Each channel is associated with one of the five groups; the default is the base group.

A functional diagram of the M1051 shows the relationship between groups and channels.
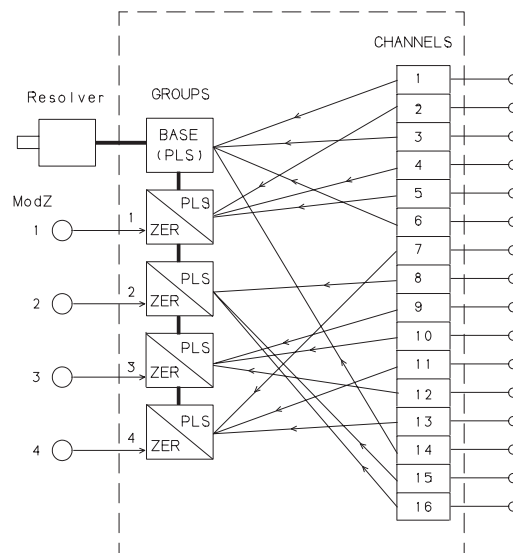
Key Functions

The programming key sequences are fairly general for all modes. The key functions are described below.

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 and Group Numbers in the second window can always be increased and decreased to display the information about those items. However, programming must be enabled (PE input TRUE), to edit the values in the other windows to the right.

Right Arrow Key:
If programming is enabled, use the Right Arrow Key to change the window that may be edited. Editing may occur in the window with the blinking digits. Also, from the Default Mode, the Right Arrow Key will cause either the Tach and Position, or the Brake Stop Time to be displayed.

Recall Key:
The Recall Key is used to recall setpoints in Channel Setpoint mode. Also, from the Default Mode, the Recall Key jumps directly to the Setpoint programming mode.

Default Display
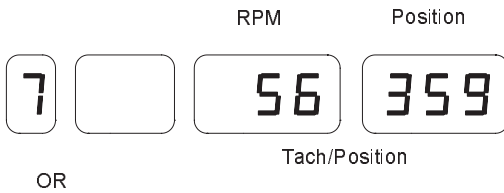
OR

Program Number, Tachometer RPM, Base Position.

Program Number, Brake Stop Time in seconds (St=9.99)

In the event of a resolver cable fault:

Program Number, and the message "CABLE" instead of Tach and Position.

The Base Position for the M1051 is composed of the absolute resolver position plus the machine offset value that is common to all eight programs.

Scale Factor

PE and PE2 must be true for viewing or programming.

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 8. The base offset does not affect channels assigned to groups 1–4.

Base Offset

PE and PE2 must be true for viewing or programming.

The Offset value is the angle, that when added to the absolute resolver position, 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 8.

Note: See page 13 for Symbols used in programming displays.

Group Types

PE and PE2 must be true for viewing or programming.
If none of the 16 channels use any of the four extra groups, then the display shows that there are no current group assignments.

```
┌──┐ ┌──┐ ┌────┐ ┌────┐
│  │ │  │ │ Gr │ │ non│
└──┘ └──┘ └────┘ └────┘
       Groups = "none"
```

If any group is in use, then the display will show the first group being used.

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ G  │ │ 1  │ │Gt= │ │PLS │
└────┘ └────┘ └────┘ └────┘
           PLS Group
```

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ G  │ │ 2  │ │Gt= │ │ZEr │
└────┘ └────┘ └────┘ └────┘
          ModZ Group
```

> **NOTE/CAUTION**
> *If you want to clear out all group assignments, INC or DEC the Group Number until "Gr non" appears, and press the Mode Key. The "Gr non" selection should not be left on the screen, or the group assignments will be cleared when the Mode Key is pressed, or after about one minute of no keystrokes.*

Group Positions 1 to 4 are composed of the absolute resolver position plus the individual Group Offset or Group ModZ Offset depending on the Group Type. If the Group Type is "PLS" then the Group Offset is used. If the Group Type is "Zer" (ModZ means Modified Zero), when the ModZ Input for that Group is triggered, the Group ModZ Offset is computed to yield a ModZ Group Position of 0. The ModZ Group Position advances as the resolver turns until one full revolution has been completed and then the position is undefined until the next ModZ trigger.

The Base Group is always a Standard PLS Group (meaning that it does not have a ModZ feature associated with it, and that the Base Offset is used for computing the base position.)

Groups 1 to 4 are selectable as PLS or ModZ types. If a Group is of the Standard PLS type, the Group Offset is utilized for that Group.
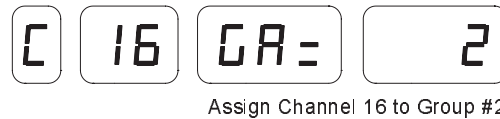
```
                    Offset      Position
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ G  │ │ 1  │ │ 24 │ │124 │
└────┘ └────┘ └────┘ └────┘
          Group Offset
```

If the Group Type is ModZ, the Group Offset is not used. Instead, there is a parameter called the Inhibit Zone.

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ G  │ │ 2  │ │In= │ │ 45 │
└────┘ └────┘ └────┘ └────┘
     Group ModZ Inhibit Zone
```

The ModZ Inhibit Zone is an angular zone wherein the ModZ cycle may not be retriggered. The Inhibit Zone begins when the ModZ cycle is originally triggered (angle = 0), and continues up to the preprogrammed angle. Once the ModZ cycle has progressed beyond this Inhibit Zone, the ModZ cycle may be restarted by retriggering the ModZ input. A group may not be selected as a ModZ group if the Brake Wear Monitor is in use (i.e., the Brake Wear Limits are nonzero).

Group Association

PE and PE2 must be true for viewing or programming.
Each channel may be associated with either the Base Group (default) or one of the other 4 groups.

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ C  │ │ 1  │ │GA= │ │non │
└────┘ └────┘ └────┘ └────┘
   Assign Channel 1 to Base Group
```

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ C  │ │ 16 │ │GA= │ │ 2  │
└────┘ └────┘ └────┘ └────┘
   Assign Channel 16 to Group #2
```

For each Channel 1 through 16, select the group it should be associated with. If "non" is displayed, the Base Group is selected. Otherwise, the numbers "1" through "4" indicate Groups 1 through 4. Remember that Groups 1 through 4 may be individually programmed to be either PLS or ModZ Groups. If no groups are in use, this mode will be bypassed.

Channel Type

PE and PE2 must be true for viewing or programming.

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ C  │ │ 11 │ │Ang │ │Ang │
└────┘ └────┘ └────┘ └────┘
       Angle ON/Angle OFF
```

```
┌────┐ ┌────┐ ┌────┐ ┌────┐
│ C  │ │ 12 │ │Ang │ │toF │
└────┘ └────┘ └────┘ └────┘
       Angle ON/Time OFF
```

The setpoints for a given channel may be designated as Angle-on/Angle-off (default) or as Angle-on/Time-off.

Angle-on/Time-off setpoints function by turning the output on at the selected on-angle. The output will turn off again after the programmed time has elapsed (0.01 to 9.99 seconds). Only one setpoint may be programmed in a channel used as Angle-on/Time-off
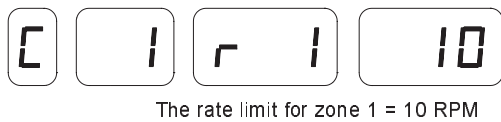
Speed Compensation

*PE and PE2 must be true for viewing or programming.*

Channel 9   Speed Comp = 10°/100 RPM

Each Channel 1 to 16 has its own programmable speed compensation. The value entered is the angle of offset to be added per each 100 RPM. The equation is:

Speed Compensated Position = Base or Group Position + Tach RPM's x Speed Comp value

The rate limit for zone 1 = 10 RPM

Channels 5 through 16 have a single speed comp value to be programmed in. Channels 1 through 4 are special in that they have Speed Comp Zones. Each of the four channels has 16 zones into which individual speed comps may be entered for 16 different RPM ranges.

The first number to enter is the rate limit ("r##, RPM") for the selected zone. The rate limit is the RPM value at which the speed comp zone becomes active. The rate limits for each zone should increase with zone number. When a zone becomes active, the zones with lower rate limits become inactive. When a zone's rate limit shows "off", no further speed comp zones are evaluated. If the "off" zone is zone 1, the channel will not have any speed comp.

The comp value for zone 1 = 47°/100 RPM
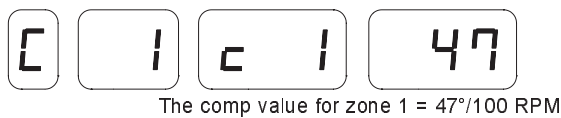
The second number to enter is the compensation value ("c##, Comp") for the selected zone. As with normal Speed Comp's, this is the angular offset added to the actual position for each 100 RPM of speed. When a certain zone is selected by having the shaft RPM above the zone's rate limit, the selected compensation value is used to calculate the speed comp for that channel.

Brake Wear Monitor Time Limits

PE and PE2 must be true for viewing or programming.
The amount of time it takes for a shaft to stop turning after the brakes are applied may be measured and compared to Caution and Danger Time Limits. This measurement can warn of brakes that are wearing out and may need to be replaced for safety reasons. If the shaft is turning and the brakes are applied, the "stop" signal may be wired into the "BI" brake input on the unit. Upon receiving this "stop" signal, the Brake Stop Timer begins counting, and if the shaft stops turning before the Caution Limit is exceeded, Outputs 7 and 8 will reflect a "Safe" condition. If the Stopping Time is between the Caution and Danger Limits, the "Caution" condition will appear on the outputs. If the Shaft fails to stop before reaching the Danger Limit, the "Danger" output condition will appear. When stopped, the brake timer may be cleared to the Caution condition by asserting the Brake Clear Input (otherwise used as the ModZ 1 Input).

Brake Output Conditions on Outputs 7 and 8		
Condition	Output 7 (Caution)	Output 8 (Danger)
Safe	0	1
Caution	1	1
Danger	1	0
0: OFF (De-energized)		1: ON (Energized)

Caution Limit = 1.00 seconds.

The Danger Limit will probably need to be entered first to allow room for the Caution Limit to be changed. The relationship between Caution and Danger Limits is as follows:
 $0.00 \leq$ Caution $\leq$ Danger ≤ 9.99 seconds.

Danger Limit = 1.25 seconds

Turn off the Brake Wear function by setting both limits to zero. Setpoints on channels 7 and 8 will not be executed so that the outputs can be use by the Brake Wear Monitor. This mode will be skipped if any ModZ groups are in use.

Motion Limits

PE and PE2 must be true for viewing or programming.
The Motion Output is controlled by the Low and High Motion Limits.
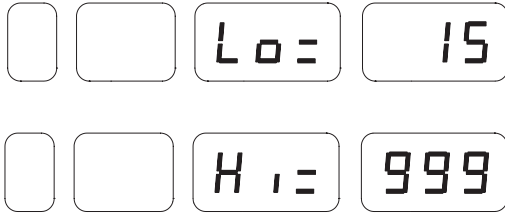
If the shaft RPM is between the Motion Limits inclusively, the Motion output will be energized. Motion Limits are common for all eight programs.

Program Number Selection

PE and PE2 must be true for viewing or programming.
Program Number Selection is allowed only if the following conditions are met:
- The shaft is not turning (RPM < 4),
- The Program Enable is on.

Current Pn = 1   New Pn = 7
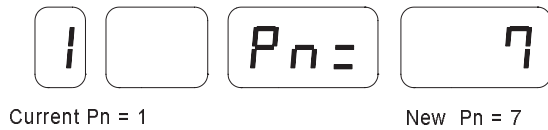
The Program Number may be selected from the keyboard only if the External Program Select input is off. If the External Program Select input is on, then the states of the Program Select inputs will determine the Program that is selected.

Station Number Selection

PE and PE2 must be true for viewing or programming.

Station Number 16

The Station Number for serial communications must be unique for each communicating device on the communications link. The number may be from Station #1 to #255. If serial communications should be disabled, select "off" (where #0 would be).

Serial "OFF"
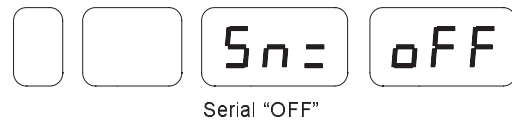
Baud Rate Selection

PE and PE2 must be true for viewing or programming.
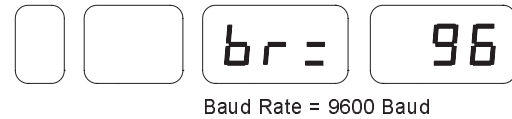
Baud Rate = 9600 Baud

The following serial communication baud rates are available for communicating with the M1051:

Displayed	Baud Rate
br= 1	110
br= 3	300
br= 6	600
br= 12	1200
br= 24	2400
br= 48	4800
br= 96	9600
br=192	19200

Setpoint Programming

Both Angle-on/Angle-off and Angle-on/Time-off setpoints are programmed in this mode. The type of setpoint is determined by the Channel Type parameter programmed above.

ON   OFF

C   12   10   24

ON at 10°   OFF at 24°
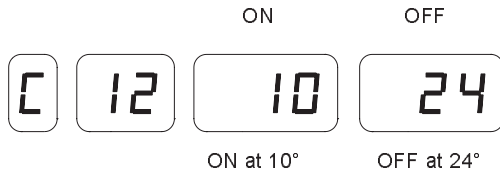
ANGLE-ON/ANGLE-OFF
WHEN the Shaft is moving in the forwared direction (CCW), Angle-on/Angle-off setpoints are defined as: Angle-on = Angle at which the output will turn on. Angle-off = Angle at which the output will turn off. These angles are programmed by using the Right Arrow Key to select the number to edit, then Incrementing or Decrementing the number. Pressing the Right Arrow Key moves you from Channel Number to:

1. On Setpoint
2. Off Setpoint
3. "Pulse, 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:

> Low channels (1 to 8) are limited to a total of 80 setpoints.
> High channesl (9 to 16) are limited to a total of 80 setpoints.

C   4   100   2.45

ON at 100°   OFF after 2.45 seconds

ANGLE-ON/TIME-OFF
Angle-on/Time-off setpoints function by turning the output on at the selected on-angle. The output will turn off again after the programmed time has elapsed (0.01 to 9.99 seconds). Edit the Angle-on/Time-off setpoint in a manner similar to the Angle-on/Angle-off setpoint, except that only one Angle-on/Time-off setpoint is allowed per channel.

Pressing the Mode Key again will return the unit to the default display.

Symbols Used in Programming Displays

Symbol	English	Function/Description
Ang	Ang	Angle
br	br	Baud rate
C	C	Channel
c	c	Compensation value for zone
CA	CA	Caution
CABLE	CABLE	Cable
dA	dA	Danger Limit
G	G	Letter G
GA	GA	Assign channel # to group #
Gr	Gr	Groups
Hi	Hi	High
In	In	Inhibit zone
Lo	Lo	Low
oF	oF	Base offset
Pn	Pn	Program number
r	r	Rate limit for zone
SC	SC	Speed compensation
SF	SF	Scale factor
Sn	Sn	Station number
St	St	Stop time
toF	toF	Time off

5. M1051 Troubleshooting Guide

Symptoms	Possible causes
Unable to program unit parameters (Scale Factor, Offset, etc.)	• Is the Program Enable Input (PE) false? (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 set points, the PLS program may already have 80 set points.
Program memory is changing by itself.	• Has the program number been changed to a different number (P1-P8)? • Have proper grounding and shielding practices been applied? • Is the Program Enable 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 M1051 unit 2. With main terminal block removed from unit, measure with ohm meter the followings: A. Term. 10 to Term. 11 (R1 to R2) = 15 to 50 ohms B. Term. 7 to Term. 9 (S1 to S3) = 50-150 ohms C. Term. 6 to Term. 8 (S4 to S2) = 50-150 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)

6. How to Order

1. 1051 PLS

SAC-M1051-010	Basic unit combines 16 power outputs, fault detection and indication (*with* electromechanical relays); 8 PLS outputs (*without* relays)
SSC-M1051-010	Slave unit
SA2-M1051-010	220 VAC unit
SA4-M1051-010	240 VAC unit

2. Relay Output Chassis

*ASY-RLYCH-08RL	Chassis for 8 EM-relay outputs and built-in power supply
*ASY-RLYCH-08SS	Above chassis for 8 solid-state relay outputs
*AS2-RLYCH-08SS	220 VAC unit
*AS4-RLYCH-08SS	240 VAC unit

3. Power Output Relays

Select the number and type of relays required:

KSD-012DC-10A	EM relay, SPDT, 120 VAC @ 10 Amps resistive **(for external ASY-RLYCH-08RL Relay Chassis only)**
KSD-A12DC-10A	EM relay, SPST, 120 VAC @ 10 Amps resistive **(for M1051 and ASY-RLYCH-08SS only)**
KSS-60VDC-3AMP	Solid-state relay, 60 VDC @ 3 Amps
KSS-120AC-3AMP	Solid-state relay, 120 VAC @ 3 Amps
KSS-200DC-1AMP	Solid-state relay, 200 VDC @ 1 Amp

4. Position Transducers

The M1051 PLS 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 the appropriate accessories.

5.   Cables

1. Required Cables

CBL-09S22-DAxxx   9-wire shielded cable with flying leads to DB9 male connector. "xxx" indicates length in feet, standard lengths are 5, 10 or 20 ft. and custom lengths in 10 ft. increments.

CBL-RLYCH-DA4   15 conductor cable with overall shield 4 ft. length and sub "D" connector on both ends for interconnection of relay chassis to PLS

2. Recommended Resolver Cables

In the following part numbers, replace xxx by the desired length in feet. Length ordered must be either 010, 020, 050 or increments of 50 feet (i.e., 100, 150, etc.)

CBL-10T22-Mxxx   22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, with 10 pin MS connector

CBL-10T22-Cxxx
22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, without connector

WARRANTY

CAUTION