M1250 Mini•PLS
(Programmable Limit Switch, Tachometer and Motion Detector)
Instruction & Operation Manual

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MINI•PLS™ Model M1250

Introduction

The Mini•PLS, Model M1250 is the fastest and most versatile PLS family in the market. We call it "Mini" because of the small compact size, but it is big in performance.

In fact, Mini•PLS is ***three-in-one:*** **Programmable Limit Switch, Tachometer** and **Motion Detector**. The powerful microprocessor and the revolutionary design make the Mini•PLS an extremely compact, fast and versatile solid-state replacement of electromechanical cam switches and older technology electronic programmable limit switches. The high accuracy, reliability, operating speed and convenience of operation assure greater efficiencies in manufacturing, helping to increase production and reduce cost.

Principle of Operation

The Mini•PLS consists of two parts, one being a position transducer mounted on the machine, and the other a programmable unit mounted in the machine control panel. The position transducer in this case will be a resolver that produces a rotary position signal. This position signal is converted to digital format in the programmable unit, displayed on the front panel and compared to the dwell setpoints programmed into the PLS. When the process cycle reaches these setpoints, outputs are enabled or disabled, starting or stopping desired functions during the cycle.

Absolute Positioning With Programmable Scale Factor

The resolver provides absolute positioning, that is, the Mini•PLS always gives true position even upon machine movement after power outage. Further, a programmable scale factor up to 999 (resolution of 1000 per turn) is provided to meet the required system resolution or for direct readout in engineering units.

Simple Front Panel Programming

The Mini•PLS is fully front panel programmable with convenient tactile keyboard, and yet secure against any unauthorized program changes. Opening of an external user provided key switch inhibits any program changes on the front panel. No special programming language needs to be learned. The programming functions are designed to duplicate the mental process used in setting up electromechanical cam switches.

Single Resolver

The Mini•PLS combines the ruggedness of a brushless resolver and the reliability of an advanced solid-state control. The rugged heavy duty NEMA 13 (IP54) single turn resolver can be mounted on a machine in any hostile environments, such as; mechanical shock, vibrations, extreme humidity and temperature changes, oil mists, coolants, solvents, etc. The programmable control unit can be mounted up to 2500 feet away in a control panel. The splash-proof, oil-tight front plate permits the unit to be installed directly on the machine itself, if so required. The ratiometric converter assures high tracking speed of 1800 RPM and high noise immunity.

Modular 40 Channels in 6" x 4" x 6" Enclosure

The ultramodern technology used by Autotech has made it possible to house 40 channels in such a small, space-saving enclosure. The system flexibility is further enhanced by the modular construction. The unit can be expanded up to 40 channels using 5 modules of 8 channels each. A "cam module" with desired logic level or power outputs, or a separate chassis with plug-in power relay outputs can be selected to match the application. Parallel BCD position and tach output modules can be inserted in slots 4 or 5. This modular concept also permits an easy adoption in field to the future technological developments by simply adding new modules to the same basic unit.

No Batteries, Nonvolatile EEROM Memory

The scale factor, offset, dwell setpoints and motion detector setpoints are all stored in nonvolatile EEROM memory as they are entered by the user. The information is retained indefinitely after power loss or machine shutdown, eliminating need for back-up batteries and related hazards.

Program Stored in Transportable Plug-in Modules

The program setpoints are stored directly in the "cam modules" in nonvolatile EEROM memory. The information is retained without power, even when the modules are taken away from the Mini•PLS. This unique feature of program storage in the "cam modules" permits programming of various modules for different jobs or spares, reducing downtime and eliminating eventual errors due to hurried reprogramming at job changes. Also, the "cam modules" can be programmed at a central place, such as corporate headquarters, and distributed to various plant locations.

Variety of Plug-in Output Modules

The plug-in "cam modules" are optically isolated and are available with TTL, PNP or NPN type of logic level outputs. Power cam modules are also available with AC (120 VAC @ 1 Amp) or DC (10–28 VDC @ 1 Amp) ratings. Optional electromechanical relays (10 Amp) and solid-state AC (3 Amp) or DC (3 Amp) relays are mounted on a separate chassis. All these relays are plug-in type for easy field replacement. The solid-state relays are optically isolated. Optional parallel BCD position and tach output modules with built-in PC-handshake, as well as analog position/tach output modules are available for remote readouts or control devices.

Versatile Offset

An extremely versatile full scale programmable offset eliminates all calculations on the part of the operator, while matching "resolver zero" to "machine zero" or while compensating for machine wear and speed changes. After the resolver is mounted on the machine shaft, all you have to do is align the machine to a mechanical zero reference, e.g., Top Dead Center on a press, and "Auto-Zero" the Mini•PLS. The resolver offset will automatically be calculated and programmed, so that the position display reads zero. If required, a "machine offset" other than zero can be programmed by direct numerical entry. To obtain a precise machine operation, the offset can also be fine-tuned in motion by using "+" and "–" keys.

Multiple Setpoints (up to 500) On Each Channel

All the 40 channels of Mini•PLS can be programmed for multiple setpoints without any restrictions. Depending upon the scale factor selected, up to 500 dual setpoints can be programmed on each of the 40 channels. Just like an electromechanical cam switch, the dwell setpoints on Mini•PLS can be programmed through zero, e.g., "on" at 350 and "off" at 10.

Built-in Tachometer

In addition to the normal PLS function as described above, the Mini•PLS has a built-in tachometer. By pressing the TACH key, the unit goes in tachometer mode and the display shows shaft speed in RPM. When used with computer controls, optional analog or digital BCD Tach output modules can be inserted in slots 4 or 5 to provide shaft speed information to variable speed drives.

Built-in Motion Detector

In tachometer mode, a motion detection "window" with low and high preset points can be programmed. Direct entry of low and high limits together with independent fine-tuning of each limit permits quick programming and in-motion adjustments. The motion detector status is indicated on front panel by an indication light and an NPN open collector output is available at the main terminal block, without occupying any of the "cam" output circuits. In case a remote power relay chassis is used an independent motion detector relay is provided on the relay chassis.

Program Duplication at the Touch of a Button

When various modules need to be programmed identically, use of program duplication key saves time and avoids errors by making fast copies of the original program. Just enter the ORIGIN slot number, select the COPY slot, press DUP key and the program is copied on the corresponding "cam module."

Write Protect

PNP and NPN type of Cam Modules are shipped with a factory wired jumper, which enables the modules to receive any program. If "Write Protection" of the program is required after the machine is adequately set up, cutting the jumper will disable module programming. This feature is especially useful when some of the cam settings should not be accessible to the unauthorized personnel and, once adjusted, need not be changed frequently. Installing the jumper back into place will enable the module for programming changes, if so required.

Multiple Program Selection

The multiple program selection capability of Mini•PLS makes setup changes for different jobs just as simple as turning a rotary selector switch. Several "cam modules" can be preprogrammed and wired in parallel. Using an external selector switch, a program corresponding to the job to be performed can be selected simply by turning the knob. When TTL type of Cam Modules are used, multiple program selection is simply achieved by using a multiplexing input at terminal 4 of the Cam Module.

Operation At 1800 RPM, Adjustable in Motion

The high speed ratiometric resolver-to-digital converter and the micro-scan time of 57–85 microseconds guarantee perfect machine operation at speeds of up to 1800 RPM. In Mini•PLS, all the program variables are active in the memory immediately as they are entered by the user. This feature permits program changes and fine-tuning with machine in full motion at 1800 RPM. The "+" and "–" keys are especially useful to fine tune the machine control for maximum productivity.

Revolutionary New Design Yields Ultra High Speeds

The Mini•PLS converts the resolver signal to digital format, compares **all** the setpoints on **all** the 40 channels and activates **all** the outputs in a maximum of 85 microseconds. This is at least two orders of magnitude faster than programmable controllers and at least one order of magnitude faster than any PLS currently on the market. With one 8 channel module plugged-in, the scan time will be 57 microseconds.

Parallel Link

Parallel BCD output modules with built-in PC-handshake for easy interface to programmable controllers or remote displays are available and can be inserted in slots 4 or 5. The TTL, PNP or NPN type of BCD outputs allow more flexibility for interface to external devices.

Consult factory for availability of special modules.

Choice of Front Panel, Back Panel or NEMA 12 (IP52) Enclosure Mounting

The basic Mini•PLS unit with its sealed front plate is designed for front panel mounting. The Mini•PLS can also be purchased in a back panel mount version with built-in power relay output chassis. This back panel model can be mounted either inside the user control panel or in a NEMA 12 (IP52) enclosure provided by Autotech.

Special Safety Feature Added to M1250 Mini•PLS Model SAC-M1250-010G

The SAC-M1250-010G Mini•PLS has a special added safety feature that affects Channel 1 only (Channels 2–40 remain standard.) The purpose of this feature is to allow Channel 1 to be turned on only within an allowable window, thereby preventing the operator from harming equipment or personnel by accidently activating the Channel 1 output outside of the allowable angle range. See Section 4, Programming, page 22 for more information.

2. Specifications

Input Power:
105--135 VAC, 50/60 Hz, 35 W exclusive of load
(220 VAC or 240 VAC option)

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

Resolution and Scale Factor:
Resolution and scale factor are defined as follows:
The **Resolution** is defined to be equal to the counts per revolution of the resolver.The **Scale Factor** is defined as the desired resolution (counts/rev) minus one.
Resolution: 17 to 1000
Scale Factor: 16 to 999

Scan Time:
57 µsec for 1 cam module
64 µsec for 2 cam modules
71 µsec for 3 cam modules
78 µsec for 4 cam modules
85 µsec for 5 cam modules

Number of Dual Setpoints Per Channel (On/Off):
Resolution ÷ 2

Offset:
Programmable “0” to full revolution

Motion Detector Limits:
Low setpoint: up to 1899 RPM (max.)
High setpoint: up to 1900 RPM (max.)

Number of programmable channels:
40 (5 output modules with 8 channels each)

Slave Systems:
Up to 7 M1250’s may be slaved to one master unit, giving additional 7 x 40 channels (total 320) using the same position transducer (The slave shares the position transducer with the master.)

Input/Output

Program Enable :
Contact closure to Sig. Ref; or a solid-state switch 0.8 V @ 10 mA.

Motion Detector Output:
NPN sinking, 30 VDC max. @ 100 mA (for Output Specifications for N, P, T, see **Table 4** on the next page.)

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 an N type of cam module 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.
Cam Module required : N type.
Cable: Prewired 4 feet with DB15 connector on one end.
Relays: Relay chassis is available for EM or Solid-state relays.
Electromechanical relays (Part# KSD-A12DC-10A):
120 VAC @ 10 Amp, SPST
Solid-State AC relay (Part# KSS-120AC-3AMP)
24–280 VAC @ 0.2–3 Amp, zero cross-over switching triac output relay,optically isolated
Solid-State DC relays:
Part# KSS-60VDC-3AMP: 960 VDC @ 3 Amp, optically isolated
Part# KSS-200VDC-1Amp :0–200 VDC @ 1 Amp, optically isolated

Special Output Modules

Digital Position/Tach Output Modules:
Digital output format: BCD
Digital output Interface:
TTL, PNP source transistor or NPN sink transistor, characteristics same as those of logic level cam output modules. **See Table 1.**
Module Update Rate:
Background task, RPM dependent (consult factory).
PC Synch Circuit and Data Transfer Command:
(*Optional*)
0 to 24 Volt logic input (edge triggered, i.e., data transfer on both rising and falling edges)
Logic Low: 0 to 0.8 V @ 3.2 mA
Logic High: >2.4 V @ 0.4 mA
Timings: Data latches between 30 µs–100 µs after data transfer edge
Tach Full Scale Range: 0–1000 RPM

Analog Position/Tach Output Module
Output: 4–20 mA (sourcing or sinking) or 0–10 VDC
Position or Tach: DIP switch selectable
Position/RPM range for max Output: DIP switch selectable

Table 1. Cam Output Modules

Output Type	Logic Level			Power	
	TTL*	PNP Source Transistor	NPN Sink Transistor	AC	DC
Part Number	ASY-M1250-08Tx	ASY-M1250-08Px	ASY-M1250-08Nx	ASY-M1250-08AC	ASY-M1250-08DC
Number of Outputs per Module	8	8	8	8	8
Logic True	2 VDC @ 15 mA 2.4 V @ 3 mA (20 µA leakage when Tristated)	Transistor ON 1.7 V drop @ 100 mA	Transistor ON 1.1 V drop @ 100 mA	1 Amp max. per channel, max. 4 A per module	1 Amp max. per channel, max. 4 A per module
Logic False	0.35 VDC @ 24 mA (0.4 mA max. leakage when Tristated)	Transistor OFF 0.2 mA leakage @ 50 VDC	Transistor OFF 0.1 mA leakage @ 50 VDC	3.0 mA max. per output	0.1 mA max. per output
Rated Voltage	5 VDC	50 VDC	50 VDC	105–135 VAC, 60 Hz	10–28 VDC
Response Time	Less than 1µs	12 µs	12 µs	Turn “ON” 12 ms Turn “OFF” 25 ms	Turn “ON” 30-50 µs Turn “OFF” 15-40 µs
Electrical Isolation	2500 V between control circuit and output circuit				

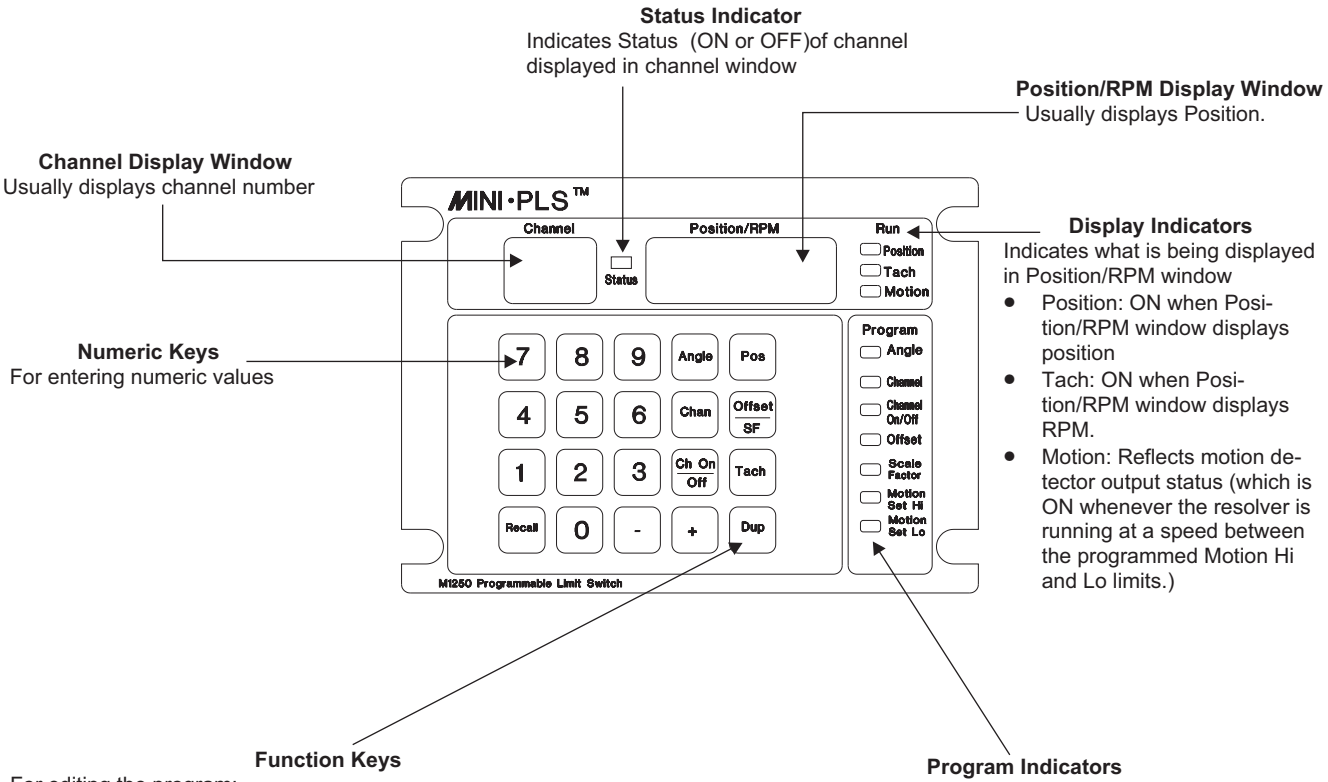
*Note: Mux or Tristating input = Low active (outputs disabled) TTL level (i.e., Logic True: 0–0.8 V; Logic False: 2–5 VDC)

Position Transducers		
PLS Model	Transducers	Cable
M1250-010	Single turn resolver, such as; Autotech’s RL100, E6R, E7R, E8R, RL101, or equivalent. Maximum tracking speed, 1800 RPM.	Overall foil shielded cable, such as; Autotech’s CBL-10T22-xxxxx or equivalent. Maximum 2500 feet.

3. Installation & Operation

M1250 Mini•PLS Front Panel View

Illustration 1 — M1250 Mini•PLS Front Panel



- Ang : Press this key for angle set point entry.
- Chan: When pressed, the channel indicator, turns ON, and the unit is ready for the selection of channel to be programmed.
- Chan On/Off: When pressed, it toggles the Channel ON/OFF indicator.
- Pos : Pressing of this key displays the current position (resolver position plus static offset) in Position/RPM window, and the last channel selected for programming in the Channel window.
- Offset/SF: When this key is pressed, the current static offset is flashed in the Position/RPM window, and then the current offset is displayed; and the unit is ready for offset reprogramming. When the key is pressed again without altering the offset, current scale factor is displayed, and the unit is ready for scale factor reprogramming.
- Tach: Press this key to display current RPM in the Position/RPM window.
- + and – : These keys increment/decrement the displayed numerical values; used to fine tune programmed values.
- Recall: In *angle mode* (when angle indicator is ON), pressing of this key displays the cam setpoints values and their programmed status (i.e., whether programmed ON or OFF) in status indicator. In Tach mode (Tach indicator ON), pressing this key displays Motion Lo and Hi setpoints.
- Dup: Used to copy (duplicate) program from one cam to another.

- Angle: ON in angle entry mode; angle displayed in Position/RPM mode
- Channel: ON in channel entry mode
- Channel On/Off: Used with channel programming; Turn it ON (by pressing Chan On/Off key) when a channel being programmed is intended to be ON; and turn it OFF when channel is intended to be OFF.
- Offset: ON when Offset is being programmed.
- Scale Factor: ON when SF is being displayed/ programmed.
- Motion Set Hi: ON when Motion Hi limit is being displayed/programmed.
- Motion Set Lo: ON when Motion Lo limit is being displayed/programmed.

Rear View of Mini•PLS

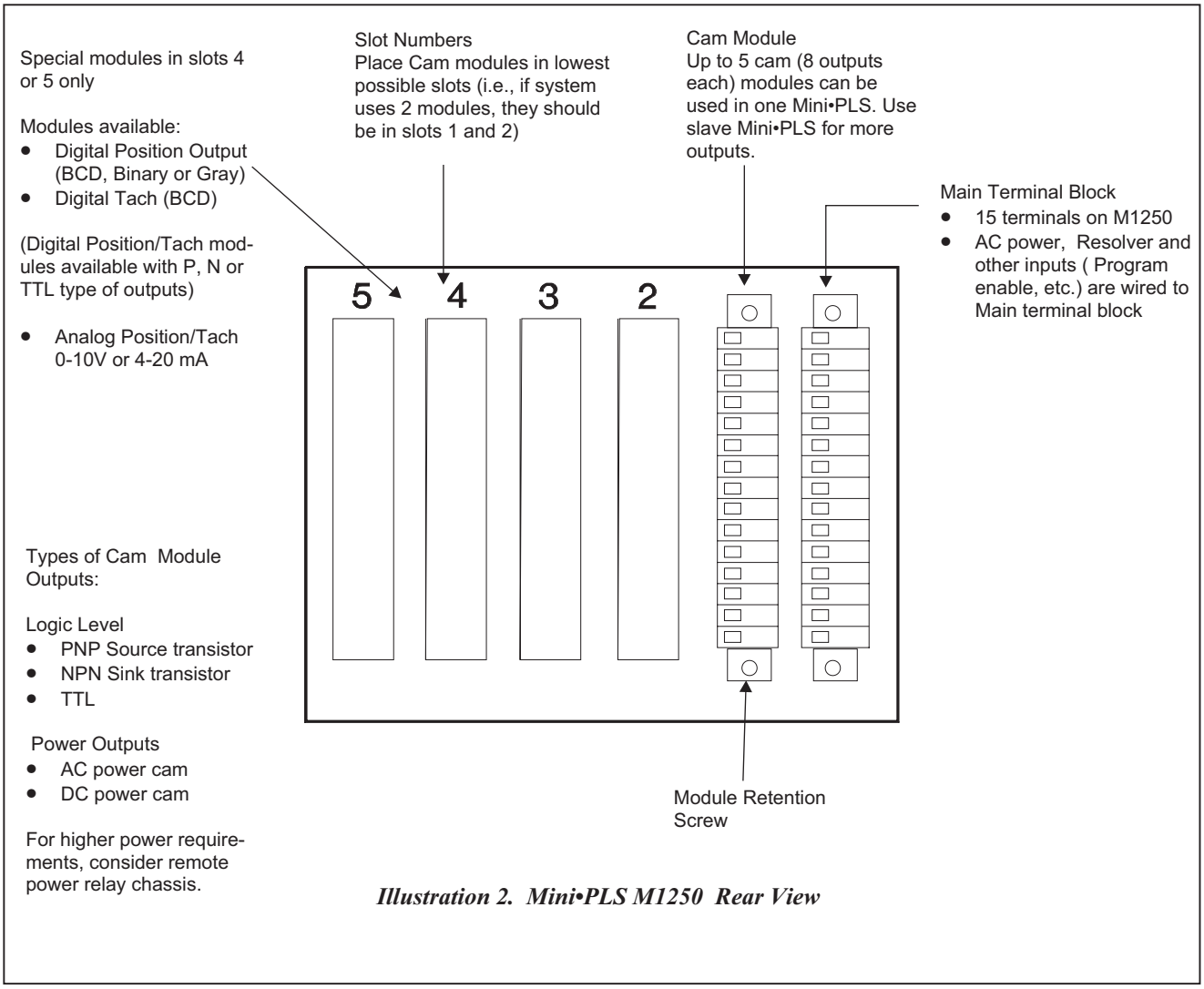


Illustration 2. Mini•PLS M1250 Rear View

Remote Power Relay Chassis

For applications requiring higher power than is available through cam modules, a remote power relay chassis may be used. The remote power relay chassis comes with 8 or 16 cam outputs and one motion output relay (total 9 or 17 relays). Further the chassis may be ordered with Electro-mechanical relays or solid-state relays. The chassis has a DB15 connector for connection to an N type of Cam module.

Back Panel Mount Mini•PLS Chassis

This chassis is an integrated system, where the Mini•PLS together with its input/output terminals and the remote power relay output chassis has been mounted on a common base plate to be installed inside the user's control panel or a NEMA 12 enclosure provided by Autotech. **See "Back Panel Mount Mini•PLS Wiring," Illustration 13.**

Installation and Wiring

Position Transducer Mounting and Wiring

See position transducer section for mounting and wiring of the transducer used in your application.

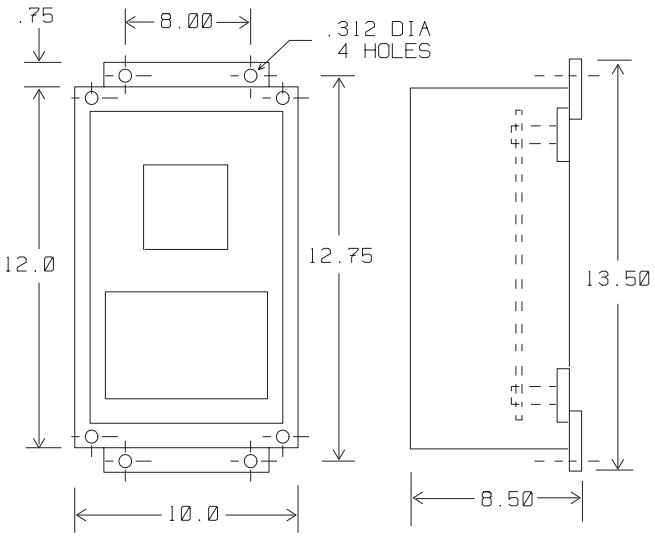
Mini•PLS Mounting (See figures below)

The Front Panel Mounting unit has a sealed front plate and is provided with four 0.188" dia holes (use 8-32 screws) for mounting. The remote power relay output chassis, if used, is mounted inside the customer's control panel. Six 0.196" dia. holes (use two 10-32 and four 6-32 screws) are provided for mounting.

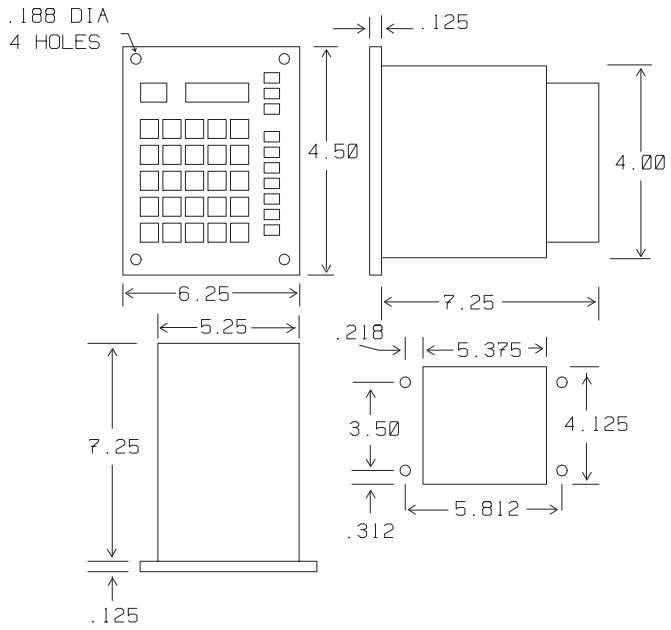
For Back Panel Mounting, the Mini•PLS, together with input terminal block and power relay outputs, is mounted on a back panel mount chassis. Four 0.25" diag. holes (use 10-32 screws) are provided for installation inside the customer's control panel close to the other existing controls.

An optional NEMA12 (IP52) enclosure with or without see-through window is available. Two holes for 1.25" conduit fittings are provided for wiring harnesses. Four 5/16" dia. mounting holes (use l/4" screws) are also provided.

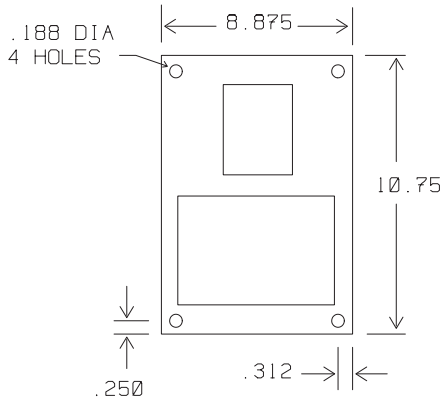
NEMA 12 Enclosure



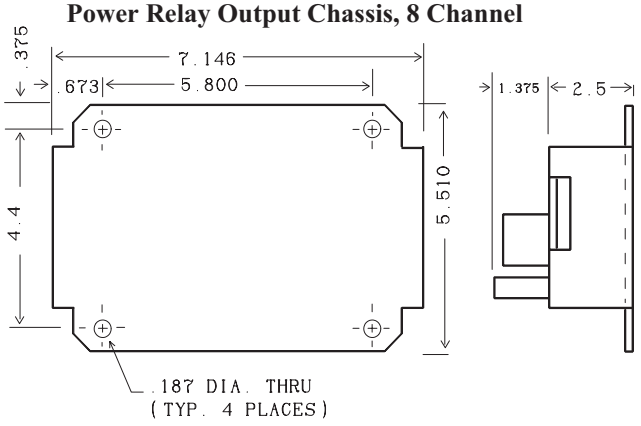
Front Panel Mount



Back Panel Mount



Power Relay Output Chassis, 8 Channel



Power Relay Output Chassis, 16 Channel

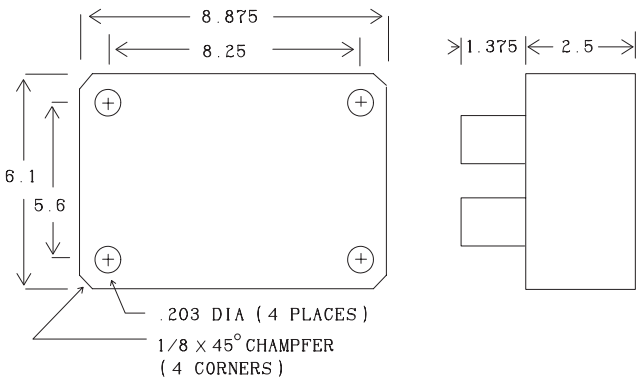


Illustration 3 — Dimensions and Mounting Diagrams

Mini•PLS Wiring

Notes:

- No special tools are required for wiring input or output devices to the Mini•PLS. Screw clamp connectors on main terminal block eliminate need for wire lugs.
- Follow grounding and shielding techniques as described in the grounding and shielding section.
- The 120 VAC input power neutral must be connected to terminal L2 and earth ground must be properly connected to the GND screw.
- When the Mini•PLS is mounted in an enclosure or a control panel, use separate conduit entrances for low voltage wiring and 120 VAC wiring.
- CAUTION: This equipment has an isolated Sig Ref (common). Failure to maintain this isolation between chassis ground (earth ground) and Sig Ref in external equipment connected to the Mini•PLS may cause electrical noise interference resulting in unpredictable operation of this equipment.

M1250 Main Terminal Block Wiring

The main terminal block on M1250 Mini•PLS has 15 terminals. These should be wired according to the wiring diagram given below. The terminal functions are also discussed below:

- AC Power Connection: The 120 VAC power is connected to terminals L1 & L2 (terminal numbers 1 & 2), where L2 is neutral. Connect earth ground to green GND screw.
- Motion detector output (term. # 6): Motion detector output is an open collector NPN sinking type output rated at 100 mA max @ 30VDC.
- Program Enable (Term.# 5): Connect to Sig Ref (term.# 4) to enable M1250 programming. Keep this terminal open to disable programming.
- Resolver input: Connected to terminals 4, 7 through 11. Reverse S1 and S3 connections to change the ascending count direction.
- Terminals 3, 12 through 15 are not used.
- Slave Units: For more than 40 cam outputs, up to 7 slave M1250 may be used. Each slave will add 40 channels, giving total up to 320 outputs. The slave units share the resolver with the master, but otherwise functions independently.
- Cable: Overall foil shielded cable such as Autotech's CBL-10T22-xxxx, must be used for wiring.

Illustration 4 — M1250 Main Terminal Block Wiring

Slave M1250 is different than the Master M1250

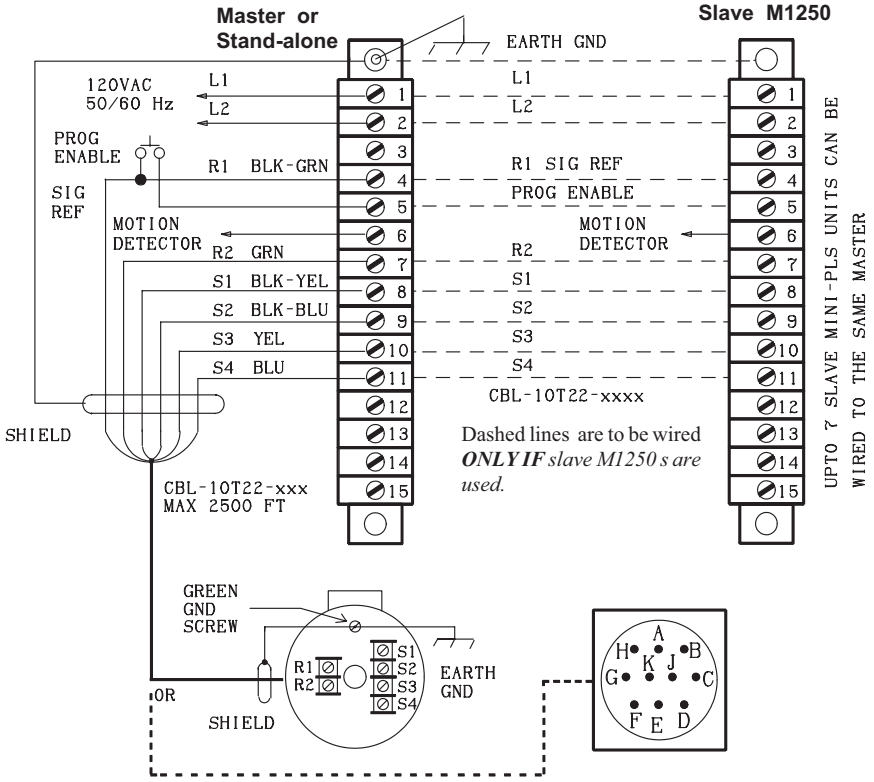


Table 2. Main Terminal Block Wiring

Resolver Connector pin OR Terminal Number	Cable wire color CBL-10T22-xxxx
A S4	Blue
B S2	black/Blue
C S3	Yellow
D S1	Black/Yellow
E R2	Green
F R1	Black/Green
G Green GND	Shield

Cam Module Wiring

The Mini•PLS M1250 Cam Module has a 15 position terminal block (ASY-M1250-08TI, -08PI, -08NI). This module is replacement for ASY-M1250-08T, -08P, -08N parts.

Wiring Cam module with Terminal Block (ASY-M1250-08xI)

These cam modules come with a quick disconnect terminal block. The functions of different terminals are given in the **Illustration 5 . Table 3** lists the channels provided by each module.

Table 3. Number of Channels per Module

Module in Slot #	Channels
1	1– 8
2	9–16
3	17–24
4	14–32
5	32–40

IMPORTANT NOTE

Cam Modules are optically isolated.
Power & sig ref must be connected on all modules.

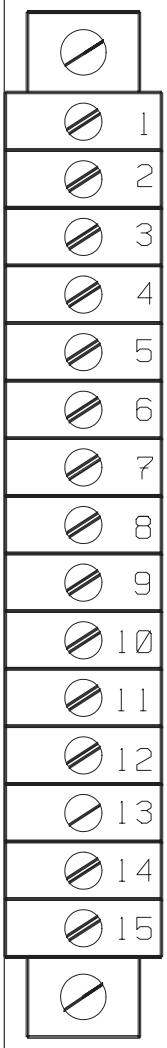
Multiple Program Selection/Output Enable

The storage of programmed set points in the individual cam modules in EEROM memory allows reprogramming of various cam modules for different jobs. Selection of the appropriate program cam for the current job might be done with the use of an external selector switch or PLC, output enable input **(pin 3)**. The output **enable pin does not affect cam outputs when jumper J1 is installed** on the cam module (see **Illustration 7**). When J1 is cut this pin may be used as follows:

- TTL Cam Modules: For multiple program selection use a multiplexing/tristating input at **pin 4** of the Cam Module.
  Multiplex input is low active TTL level input (output disabled).
- PNP and NPN Cam Modules: For multiple program selection wire **pin 3** to Sig Ref through selector switch as shown in **Illustration 7.**

Write Protect

As shown in **Illustration 7**, the PNP and NPN type of Cam Modules are shipped with factory wired jumper J2, which enables the modules to receive any program. If "Write Protection" of the program is required after the machine is adequately set up, cut the jumper J2. This will disable module programming. This feature is especially useful when some of the cam settings should not be accessible to the unauthorized personnel and, once adjusted, need not be changed frequently. Installing the jumper back into place will enable the module for programming changes, if so required.



Terminal designations for Cam modules with terminal block (ASY-M1250-08xI)

Pin #	Function
1	NC
2	NC
3	(P & N option only) Output Enable (See Multiple program selection)
4	(T option only) Tristate input
5	Channel 1
6	Channel 2
7	Channel 3
8	Channel 4
9	Channel 5
10	Channel 6
11	Channel 7
12	Channel 8
13	(T Option only) Vcc (5VDC max)
14	Sig Ref (Common) (Connect on all modules)
15	(P & N Option only) Vs+ (50VDC max)

NC : Not Connected

Illustration 5 — Cam Module Terminal Designations

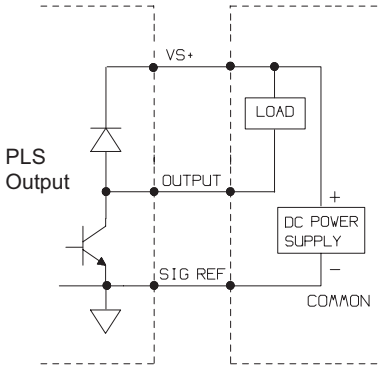


Illustration 6a — N Type Output

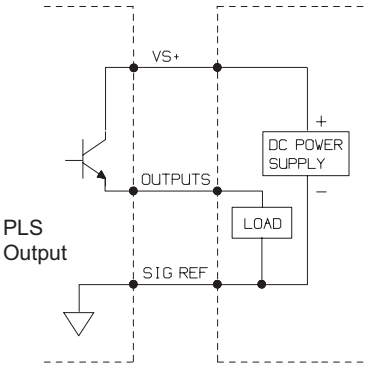


Illustration 6b — P Type Output

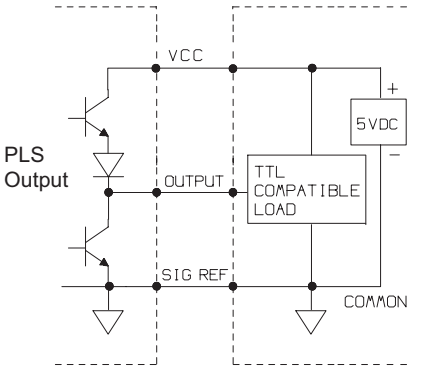


Illustration 6c — N Type Output

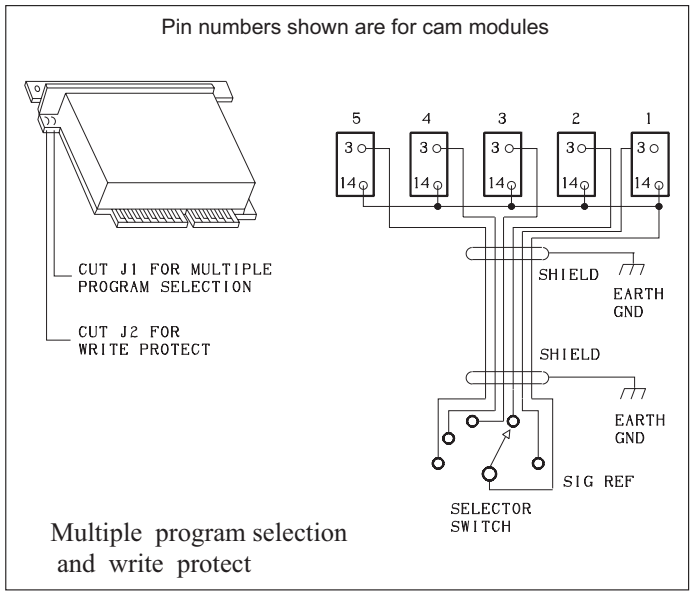


Illustration 7 — Cam Module Wiring

AC Power Cam Wiring

AC and DC power cam use a quick disconnect terminal block for wiring to the module (ASY-M1250-08AC and ASY-M120-08DC). **Illustration 8** identifies the terminal on the AC and DC power cams,and shows wiring a typical output.

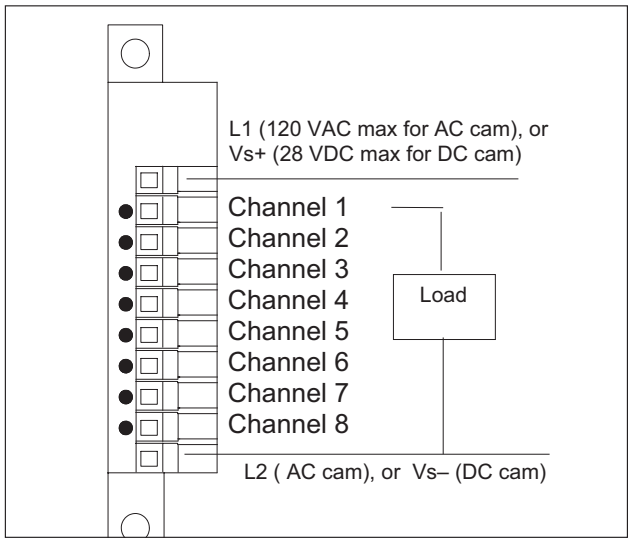


Illustration 8 — AC and DC Cam Output Wiring

Cam Module on M1250

Relay Outputs

NC: Normally Closed
NO: Normally Open
COM: Common

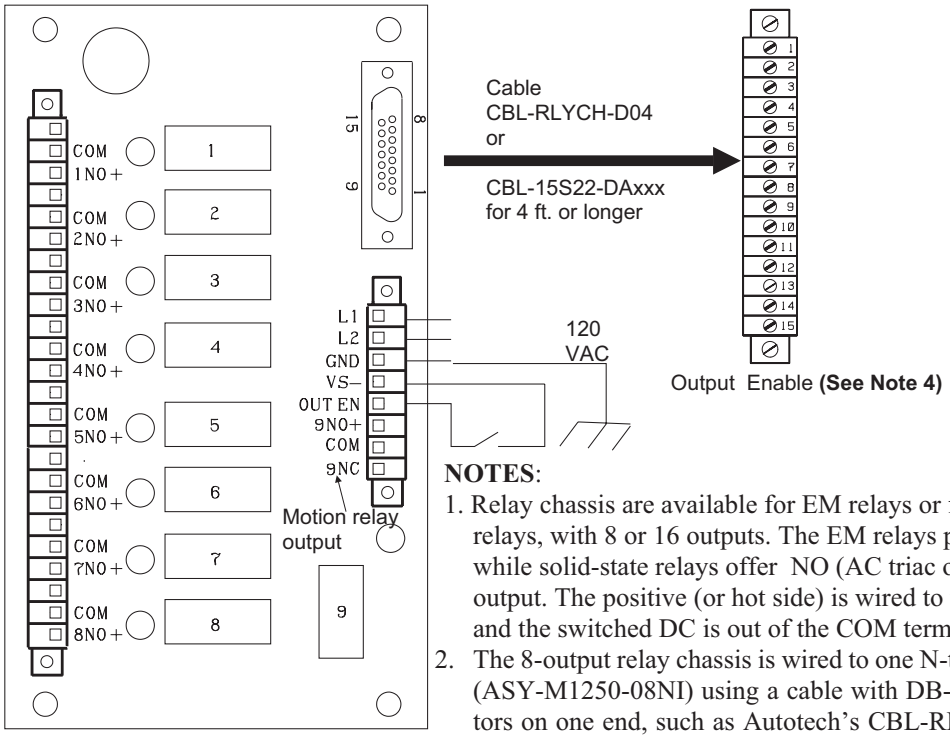


Illustration 9 — 8-Output Relay Chassis

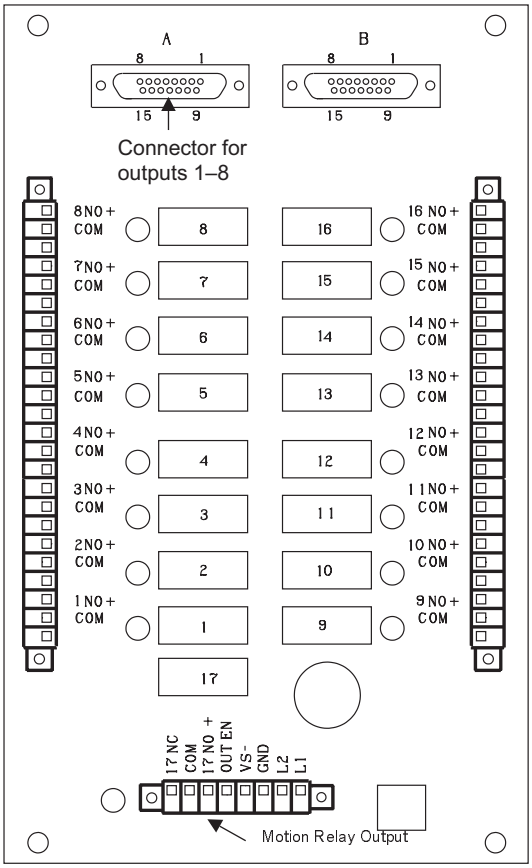


Illustration 10 — 16-Output Relay

NOTES:

1. Relay chassis are available for EM relays or for solid-state relays, with 8 or 16 outputs. The EM relays provide NO while solid-state relays offer NO (AC triac or DC transistor) output. The positive (or hot side) is wired to the NO terminal and the switched DC is out of the COM terminal.
2. The 8-output relay chassis is wired to one N-type cam module (ASY-M1250-08NI) using a cable with DB-15 male connectors on one end, such as Autotech's CBL-RLYCH-D04. The 16 output relay chassis requires two cam modules and two cables.
3. **Motion Output**: Terminal #6 on the main terminal block of the M1250 must be connected to Pin #4 of Connector A, along with a jumper from Terminal #4 of the Main Terminal block to Terminal #14 of one cam module. The Motion relay on the eight channel chassis is relay #9; on the sixteen channel chassis the motion relay is #17.
4. **Output Enable:** Output Enable input on the relay chassis will be effective only after the jumper J1 on the cam module is cut. On 16 channel relay chassis, the output enable input is common to the both connected cam modules.

Table 4. DB15 Connector Pins and Functions (CBL-15S22-DAxxx and CBL-RLYCH-D04)

Pin #	Cable Color	Connector A	Connector B
1	Black	NC	NC
2	White	VS- DC Supply Common	
3	Red	VS+ [1] Unregulated 12 VDC Output	
4	Green	Motion Input	NC
5	Orange	Channel 7	Channel 15
6	Blue	Channel 5	Channel 13
7	White/Black	Channel 3	Channel 11
8	Red/Black	Channel 1	Channel 9
9	Green/Black	VS-	
10	Orange/Black	VS+ [1] Unregulated 12 VDC Output	
11	Blue/Black	[2] Output Enable	NC
12	Black/White	Channel 8	Channel 16
13	Red/White	Channel 6	Channel 14
14	Green/White	Channel 4	Channel 12
15	Blue/White	Channel 2	Channel 10

[1] Unregulated DC output voltage with limited current capability
[2] This Pin is connected to OUT EN terminal and is used by Autotech's Products to enable/disable outputs.

SPECIAL MODULES

Digital Position/Tach Output Modules:

Digital position/Tach modules have a 15-pin terminal block connector on them. See **Illustration 11** and **Table 5** in the next column.

The digital position and Tach modules are available with BCD output formats and following options:

- P, N or T type of outputs
- w/ or w/o PC sync circuit

These modules can be used only in slot 4 and/or 5 on the Mini•PLS.

PC Sync Circuit (Data Transfer)

The PC sync option on BCD modules is useful for programmable devices such as PC, which "read" the module. The reading device sends a **data transfer** signal to the module, and PC sync option then assures that data changes only between 30 µs to 100 µs after the receipt of a rising or falling edge on the data transfer input (pin #3). The Data Transfer signal is 0–24 volt logic input (*Logic Low:* 0–0.8 V @ 3.2 mA and *Logic High:* 2.4 V @ 0.4 mA) with 30 µs minimum pulse width. The data transfer takes place on both rising and falling edges of the signal.

Removing jumper J1 (the upper jumper pair) will disable Data Transfer and allow the module to continuously update the outputs. The modules without PC synch option update continuously (the update rate is dependent on the RPM and number of setpoints.)

Table 5.
Suggested Pin Definitions for
Position/Tach Output Modules
Cable : CBL-18S22-Cxxx
(All wires are 22 gauge, unless specified)

Term. #	Wire Color	Function
1	Black (12 gauge)	SigRef
2	White (12 gauge)	Vs+
3	Red	Data Transfer
4	Green	Bit 800(MSB)
5	Orange	Bit 400
6	Blue	Bit 200
7	White/Black	Bit 100
8	Red/White	Bit 80
9	Green/White	Bit 40
10	Orange/White	Bit 20
11	Brown/White	Bit 10
12	Yellow/White	Bit 8
13	Orange/White	Bit 4
14	Purple	Bit 2
15	Grey	Bit 1(LSB)

NC : Not Connected; **MSB:** Most significant Bit; **LSB:** Least Significant Bit

Modules available with P, N or T type of outputs. See Specifications & How to Order sections. See Cam module wiring in **Table 3** for typical P,N and T outputs wiring.

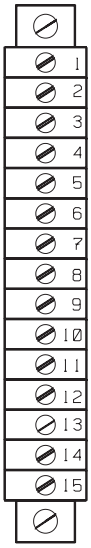


Illustration 11—
Digital Position /Tach Module Terminal

Analog Position/Tach Output Module Wiring

The Analog Position/Tach output module provides an analog signal proportional to shaft position or speed. The module may be ordered with one of the following output configurations:

- 0–10 VDC out
- 4–20 mA sourcing output
- 4–20 mA sinking output

The module has 4 Dip switches to select between Position and Tach output, and to select ranges, as shown below. Two potentiometers are provided for adjusting zero and full-scale reading within the selected range. The Module update rate is background task and is RPM dependent.

Table 6. Module Function Selection

Module Function Required	*Switch #4 Position*
Analog Position	ON
Analog Tach	OFF

Range selection

- Position: Set switches so that the scale factor (SF) is within range (e.g., if SF=359, SW1=OFF, SW2=ON, SW3=OFF)
- Tach Function: Set switches so that max RPM is within range (e.g., if max RPM=200, SW1=ON, SW2=ON, SW3=OFF)
- For overlapping ranges, any range may be used.

Full Scale	*Switch#1*	*#2*	*#3*
15–33	ON	ON	ON
27–47	OFF	ON	ON
36–75	ON	OFF	ON
60–126	OFF	OFF	ON
106–233	ON	ON	OFF
216–476	OFF	ON	OFF
415–900	ON	OFF	OFF
885–1999	OFF	OFF	OFF

Back Panel Mount Mini•PLS Wiring

The unit is factory wired and is delivered complete with all the necessary internal wiring. The user is required to wire only the input terminal block and the relay outputs. The diagrams below shows the location of the input terminal block and relay chassis. The input terminal block wiring for units with an M1250 is shown in **Illustration 13.**

NOTE: For BCD output option, please consult the factory.

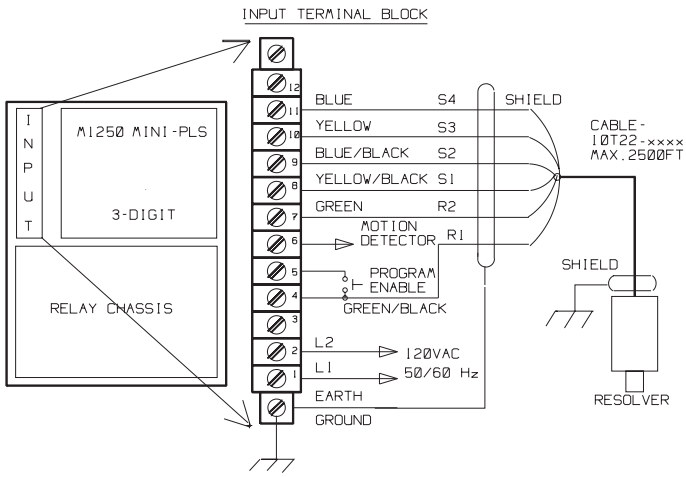
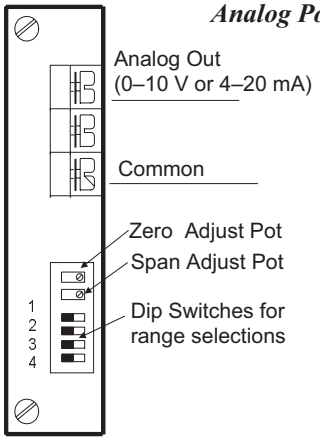


Illustration 13 — Back Panel Mount M1250 Wiring

Illustration 12 — Analog Position or Tach Module



Calibration:

- Set switches as per function and range.
- Adjust Zero and Span adjust pots for zero and maximum readings.
- For tach function, it may be convenient to put module in position mode, turn resolver to read zero position, and set zero pot; then turn resolver so that the number in position display window equals the max RPM, adjust span pot. After adjustment of pots, switch module back to tach.

Table 7. Terminal Designation on Remote Power Relay Chassis for Back Panel Mounting					
TB1		**TB2**		**TB3**	
120 VAC	**Motion Detector Relay**	**Terminal Number**	**Function**	**Terminal Number**	**Function**
GND	NO	1	Motion Input	11	+12 VDC Unregulated
L1	COM	2	Signal Reference	12	Signal Reference
L2	NC	3	Channel 1	13	Channel 9
		4	Channel 2	14	Channel 10
		5	Channel 3	15	Channel 11
		6	Channel 4	16	Channel 12
		7	Channel 5	17	Channel 13
		8	Channel 6	18	Channel 14
		9	Channel 7	19	Channel 15
		10	Channel 8	20	Channel 16

Back Panel Mount /Remote Power Relay Output Chassis: The remote power relay output chassis is designed to accommodate 16 cam output relays and one motion detector relay. The chassis has a built-in power supply . Models are available for Electromechanical relays, Solid-State AC/DC modules, or 8 EM and 8 SS relays. See *How to Order* section.

The relay chassis wiring is shown in **Illustration 14**. Terminal Designations are listed in **Table 7.**

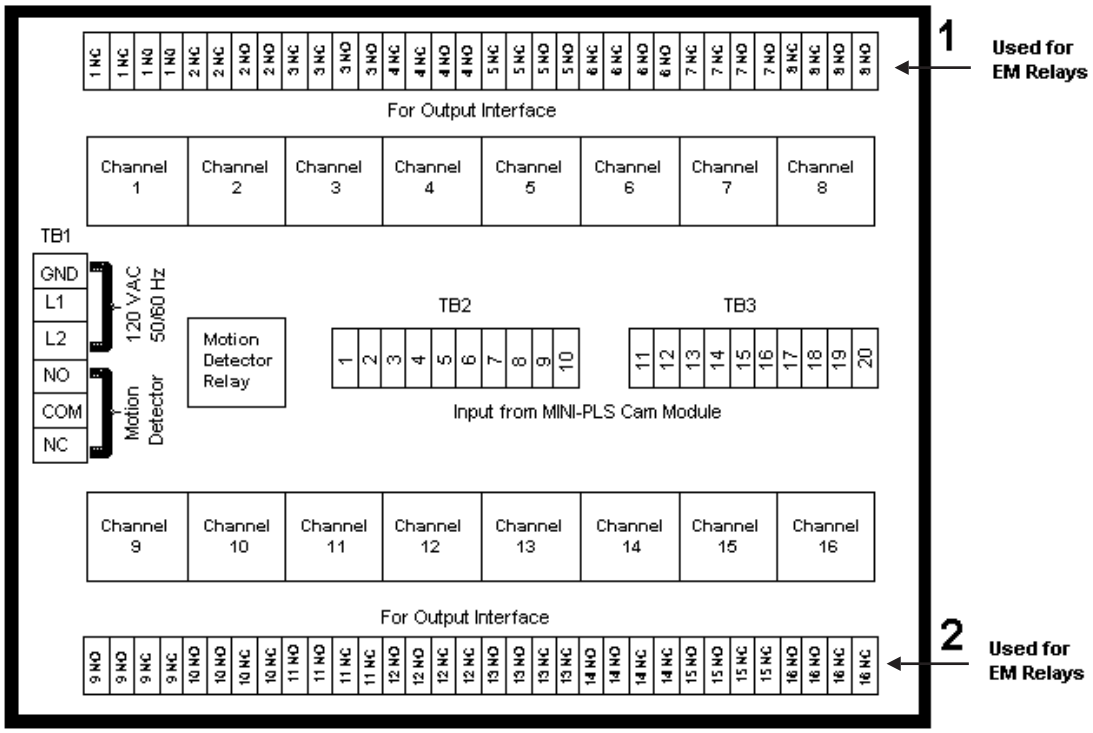


Illustration 14 — Remote Power Relay Output Chassis

Grounding and Shielding

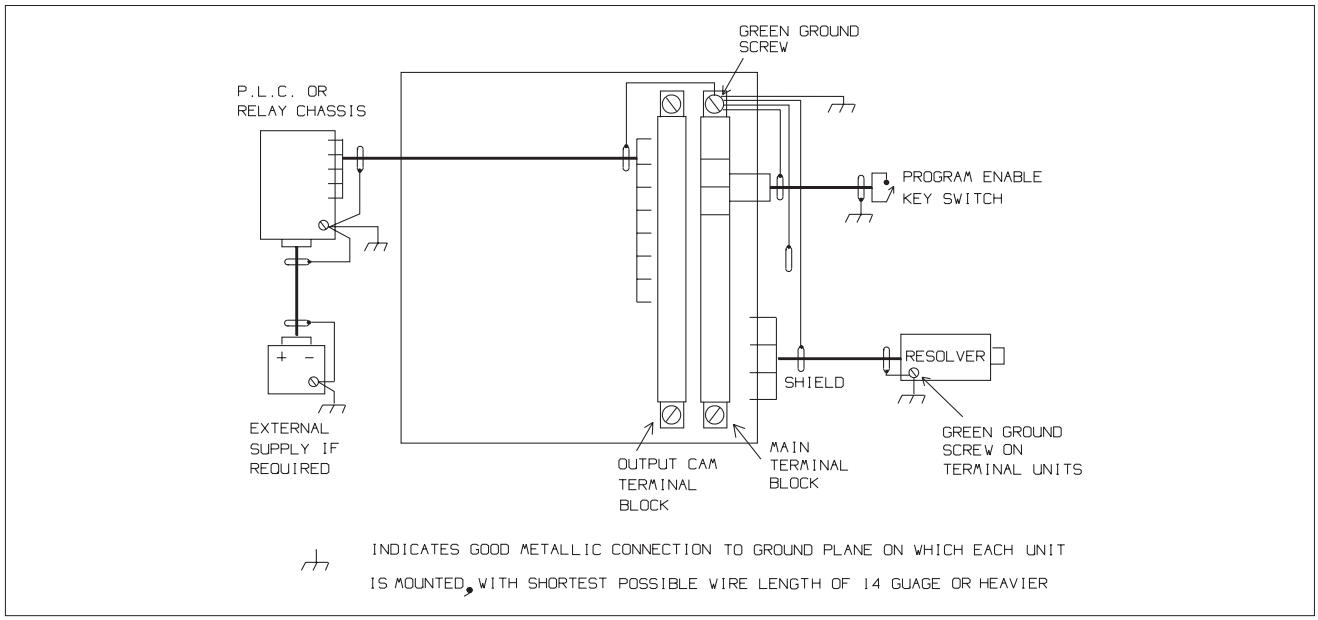


Illustration 15 — Grounding Techniques

Failure to observe any of these requirements may cause unpredictable operation and will void warranty.

1. All logic level wiring (including resolver and external power supply) must be done using **overall foil shielded** cables, with shields and equipment grounded as per above drawing. See How to Order section for suitable cables offered by Autotech.

2. 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.

3. All ground planes on which the M1250 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. Star washers should be used together with mounting bolts to ensure good electrical connections between the M1250 chassis and enclosure.

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

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

6. All **electromechanical relays,** including Autotech's relay chassis, when driven from logic level outputs (Cams), may require metal oxide varistors (GMOV'S) across each set of relay contacts. (GE-MOU-U130L10)

7. **CAUTION**: This equipment has an isolated Sig Ref (common). Failure to maintain this isolation between chassis ground (earth ground) and Sig Ref in external equipment (power supply or I/O cards) may cause electrical noise interference resulting in unpredictable operation of this equipment.

4. Programming the Mini•PLS M1250

Programming of M1250 Mini•PLS requires entering appropriate values for the following:

- Scale factor
- Offset (if required)
- Motion detector limits (if required)
- Limit On/Off Set points

General Guidelines

The general guidelines for programming the M1250 Mini•PLS are provided in the following paragraphs:

Program Enable Wiring

The Program Enable input must be low (connected to Sig Ref). On main terminal block, connect terminal #5 to terminal #4 . This connection may be done through a switch.

Error Mode

Most of the programming functions have an error mode. If you perform an illegal programming action, the **display will flash** ON and OFF to let you know. **To escape** from the error mode, press the function key you pressed last that caused the error. This will clear the error.

Function Indicator LEDs

A flashing Program LED is a reminder that a program change has been started but not concluded. Going from one function to another is possible without actually completing the reprogramming of the first function. You should make sure that the desired program change is complete before going to the next step.

Keyboard Color

The keyboard is segregated into two different types.

- White keys represent numerical entry and/or recall functions.
- Dark keys represent the Program entry functions.

Therefore, use caution before pressing dark keys.

The following section is organized in the progression most often used when programming the M1250.

Scale Factor Programming

The Scale Factor (SF) determines the resolution of the M1250 and is defined as below:

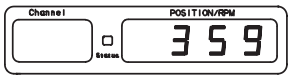
THE SCALE FACTOR IS DEFINED TO BE equal to the desired resolution (counts per turn) *minus one*. Therefore, if you want to have one turn of resolver equal to 360 counts (so that position is indicated in degrees), the scale factor will be 359. If resolver speed is above 3 RPM, scale factor changes are prohibited.

CAUTION:
When changing the scale factor, the previously programmed **"set points" will be automatically rescaled but may result in an erroneous output.** The setpoint values should be rechecked and the limits retrimmed if necessary.

Follow the steps given below to program the desired scale factor:

1. Press the **OFFSET/SF** key twice. Verify that the **Scale Factor** LED is turned On. (If not, press the **POS** key and repeat). The current scale factor is displayed in the Position/RPM window.

2. Enter desired scale factor, for example 359. As soon as you start entering the numbers, the **Scale Factor** indicator will start flashing, reminding you that the scale factor change has been started, but not concluded. If you make a mistake, just keep entering numbers until the number displayed is the scale factor desired.



3. Press **OFFSET/SF** key to enter scale factor into the memory. The flashing **Scale Factor** LED will become steady, if the number entered is acceptable.

If, while pressing **OFFSET/SF** key, the **display** starts flashing, this indicates an **error mode.** You might have entered a number beyond the scale factor range. To escape the error mode, press the **Offset/SF** key again and repeat **steps 1 through 3.**

Offset Programming

THE OFFSET OR STATIC OFFSET is the number that is added to the resolver position to determine the machine position. Thus offset may be used to electronically align the machine to the desired position display.

Displayed position =
True resolver position + offset

The M1250 maintains the offset in two parts:

- Resolver offset
- Machine offset

Resolver Offset

"Resolver Offset" as defined in M1250 is the necessary offset that should be added to the resolver position to align "Resolver Zero" to the desired "Machine Zero." The "Resolver Offset" is automatically calculated and programmed by theAuto Zero Method .

Machine Offset

"Machine Offset" is defined to be any additional offset number with "Machine Zero" as reference point. The machine offset is programmed using Numerical Entry , or the Fine Tune Method .

Total Offset

The total offset is the sum of the two offsets.

In most cases, the user is concerned with the total offset only and may use either Auto Zero Method, or the Numerical Entry Method, or a combination of the two to enter the total offset.

The two-part offset has been provided for the users who would like to align machine zero once using resolver offset, and change the machine offset frequently depending upon the speed of operation of the machine (therefore advancing or retarding all the setpoints).

Offset Programming Methods

There are three ways to program the offset:

- Auto-Zero
- Numerical entry
- Fine-tune

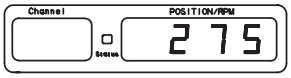
For safety reasons, with machine in motion **above 3 RPM, the Auto-Zero and Numerical entry modes are** inhibited.

Offset: Auto-Zero Method

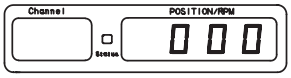
The function of the Auto-Zero mode is to automatically **calculate and program the "Resolver Offset"** so that the current resolver position is interpreted by the M1250 to be aligned with **"Machine Zero."** The "Machine Offset" equals zero after the Auto-Zero Method Process is completed.

Follow the steps listed below to Auto-Zero the machine offset:

1. With resolver shaft mechanically connected to the machine being controlled, adjust machine to its **mechanical zero**.
2. Press the **Offset/SF** key. The existing "Resolver Offset" will appear for a short interval and then the current "Machine Offset" will be displayed. The **Offset** Indicator will be illuminated. For example if the current "Machine Offset" is 275 the display will be as shown below:

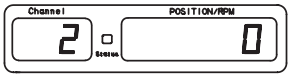


3. Press the **"0" key three times** until the Position/RPM display reads "000".



The Offset Indicator will be **flashing,** which means that the offset entry is not yet terminated.

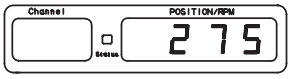
4. To terminate this step, press the **Offset/SF** key. The **Offset** Indicator will stop flashing, the M1250 will calculate the required "Resolver Offset," display it for a short interval, and go back to display new "Machine Offset" (in this case 000).
5. Press the **Pos** key. The Position/RPM display will indicate "0".



Offset: Numerical Entry Method

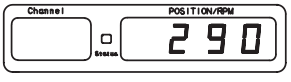
The function of the numerical entry mode is to **program the "Machine Offset"**. This method does not affect "Resolver Offset". **Note that the total offset is the sum of resolver and the machine offset.**

1. Press the **Offset/SF** key. The **Offset** LED will be illuminated. The display will flash the existing offset, and then indicate the current "Machine Offset". If the current "Machine Offset" is 275, the display window will be:



2. The new Machine offset can be entered in two ways:

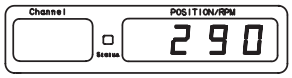
   - Enter a number corresponding to the required position, i.e., new "Machine Offset" is 290.



OR

   - Press the **"+" or "–" key** and enter a **number corresponding to the difference** between the current and the new "Machine Offset." For example, if current

"Machine Offset" is 275 and desired "Machine Offset" is 290, press **"+ "** key followed by **"1"** and **"5"** keys (290 = 275+15).



The offset indicator will be flashing, meaning that this step is not yet terminated.

To terminate this step, press **Offset/SF** key. The **Offset** Indicator will stop flashing, then display the new "Machine Offset".

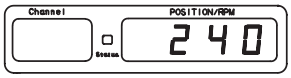
3. Press **Pos** key. The Position/RPM display will indicate the new position.

If you entered an **offset number higher than the scale factor**, the unit will go in error mode in step 3. Press **Offset/SF** key to escape the **error mode** and repeat steps 1 through 3.

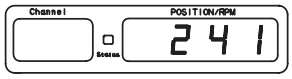
Offset: Fine Tune Method

This method affects only "Machine Offset." The "Resolver Offset " remains unchanged. **Note that the total offset is the sum of resolver and the machine offset.**

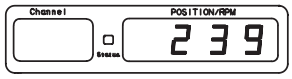
1. Press the **Offset/SF** key. The **Offset** Indicator will be illuminated, the display will flash the existing "Resolver Offset" and indicate the current "Machine Offset", say 240, the display will be as follows:



2. Press the **"+" key** to advance the Offset or **"–" key** to retard the offset as desired. In this case, the increments/decrements are entered directly into the memory. To increment 1, the display will be (240+1 = 241).



Or , to decrement 1, the display will be (240–1 = 239).



3. To terminate this step, press the **Offset/SF** key. The Offset indicator will stop flashing and then display the new "Machine Offset".

Cam Module Programming

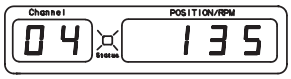
The following guidelines should be followed regarding cam module programming:

- Status indicator (LED) indicates what status (On/Off) now exists in memory of chosen channel and angle.
- Channel On/Off indicator indicates what status (On/Off) is desired to be programmed in memory at chosen channel and angle.
- The "+" and "–" keys are used for programming.
- The On and Off limits of the setpoints need to be programmed for each channel. Each channel may have more than one set point.

Dual Setpoint per Channel = Resolution ÷ 2

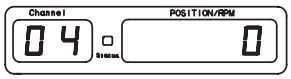
Follow the key sequence described below:

1. Press the **Chan** key. Select the channel to be programmed by entering the desired channel number ("4" for this example).

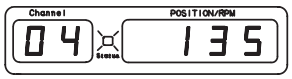


If you try to enter a number for a nonexistent cam location, you will go into the error mode. To escape the error mode, press the **Chan** key again and enter a new number.

2. Press the **Angle** key and "0" will appear in the display window.

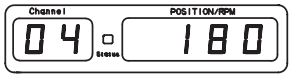


3. Before entering the new program, you must check what is existing in the memory. This can be done by pressing the **Recall** key and observing the display and the **Status** indicator.



This display indicates that channel 4 is On (see status indicator) at position 135.

4. Press **Recall** key again.



This display indicates that channel 4 is turned OFF (see status indicator) at position 180. Thus this setpoint keeps channel ON from 135 to 179.

Entering the New Program

The new program can be entered in three ways:

- Programming New Setpoints
- Erasing (i.e., programming Off) the existing setpoints and entering the new ones
- Programming from existing setpoints

Program Enable must be low to program any setpoints.

Programming New Setpoints:

Setpoints are the resolver shaft positions (angles) at which a channel is turned "ON" or "OFF".

An "ON" and the corresponding "OFF" setpoint form a **dwell.** Within each dwell an output channel can be turned "ON" or "OFF".

To program new setpoints following this procedure:

1. Verify that the Channel is empty by pressing the following sequence of key strokes:

   - Press Chan. *Channel indicator light will turn on.*
   - Enter the Channel Number.
   - Press Recall. *Display should flash to designate nothing is programmed.*

     If the channel is not empty, follow the procedure in the next section, "Erasing Existing and Entering the New Setpoints."

   - Press Recall again to stop flashing (if channel has not been programmed).

Channel Empty	Channel Not Empty
Display will flash when RECALL is pressed	Values will be displayed when RECALL is pressed

2. If the channel is empty, continue programming as follows:
   - Press Chan again. *Channel LED will turn on*.
   - Press Angle. *Angle LED will turn on*.
   - Enter First ON Setpoint angle numerically.
   - Press the **Ch On/Off** key. *Channel 0n/Off LED* is ON.
   - Press the "+" key until the display reaches the OFF setpoint. Programming is complete for this "dwell". See the Specifications Page "Resolution and Scale Factor" and "Number of Dual Setpoints Per Channel" to determine how many dwells (on/off setpoint pairs) may be programmed

     If more dwells need to be added for this channel, perform the following steps.
     1. Press Angle.
     2. Enter ON Setpoint.
     3. Press "+" to OFF Setpoint.
     4. Second dwell programming complete.

   - Press **Recall** to verify the programmed setpoints. Each press of the **Recall** key will step through the programmed dwells. The ON and OFF setpoints are denoted as follows:

ON Setpoint	OFF Setpoint
Status LED is ON	Status LED if OFF

Programming by Erasing the Existing and Entering the New Setpoints:

TO ERASE ALL THE SETPOINTS on the channel being programmed:

- Press the **Angle** key.
  Position/RPM will display "0".
- Press the **Chan On/Off** key until the Channel On/Off LED is OFF.
- Press the **"+" key** until a full revolution from "0" to "0" has been achieved.
- Press the **Recall** key.

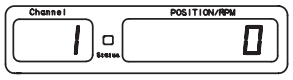
☞ —The display will flash when all locations are programmed "OFF" (erased).
—The Status indicator light will be off.

- Press the **Recall** key again to escape the flashing mode.

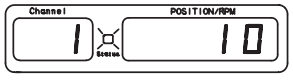
TO ENTER NEW SETPOINTS :

The following procedure outlines the steps to enter new setpoints. The values used for each display shown are for example only.

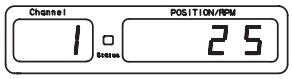
- "ON SETPOINT" The starting display will be:



- Make sure the Channel On/Off LED is "ON". If not, press the Ch On/Off key.
- Press a numeric key to enter the angle of the first set point, say 10 degrees.
  The status LED will be Off because dwell programming is not yet completed
- The following display indicates that Channel 1 is ON at position 10. *The status LED will be ON.*



- OFF SETPOINT: Press the **"+" key** to advance until you enter the required "dwell", say 15 degrees. The display window will show (10+15=25):



This display indicates that the Channel 1 is turned OFF at position 25. The status indicator will be off. This setpoint keeps Channel 1 ON from 10 to 24.

- Press **Recall** to verify the programmed setpoints. Each press of the **Recall** key will step through the programmed dwells. The ON and OFF setpoints are denoted as follows:

ON Setpoint	OFF Setpoint
Status LED is on	Status LED is off

- Repeat for all channels and all setpoints.

Programming From Existing Setpoints:

Enter the correct Channel number for programming by following this procedure:

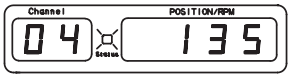
- Press Chan. *Channel indicator light will turn on*.
- Enter the Channel Number.
- Press the Recall key until the setpoint needed to be changed is displayed.

Press the Ch On/Off key to turn the LED on or OFF depending on whether you want to expand or contract the dwell.

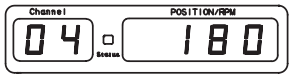
ENTERING SETPOINTS EXAMPLE (BEGINNING DISPLAY):

The following procedure is an example of how to enter setpoints. The values used for each display are for the example only.

- Press the **Recall** key.
  For this example, Channel 4 will have a 135 "On Setpoint" and 180 "Off Setpoint" already programmed.
- The existing "On Setpoint" will appear in the display window. In this example 135 will be displayed as shown below. *The status light will be ON.*



Press the **Recall** key again. The second existing set point will appear in the display window. In this example 180 "Off Setpoint" will be displayed as shown below. *The status light will turn OFF.*



TO PROGRAM NEW SET POINTS:

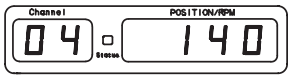
FOR this example, 140 will be the "On Setpoint" and 185 will be the "Off Setpoint" for Channel 4.

- **Press the Recall** key. The existing 135 "On Setpoint" will appear.
- Press the **Ch On/Off** key to select the programming mode "On" or "Off".

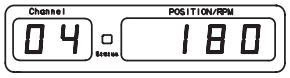
*The **Channel On/Off** LED will be ON or OFF to show the status in which set points are to be programmed.*

To Increase Setpoint	To Decrease Setpoint
Ch ON/OFF LED must be OFF.	Ch ON/OFF LED must be ON.
Press the "+" key.	Press the "–" key.

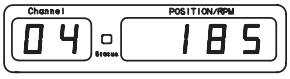
- Press the **"+ "** key to increment or **"–"** key to decrement the setpoint, until the required set point is achieved. If you want to increase the dwell **Ch On/Off** key should be ON and if you want to decrease the dwell **Ch On/Off** key should be OFF.
- The **Ch On/Off** key should be Off. Press "+ " key because we want to increase the "On Setpoint" to 140 as shown below.



- Press the **Recall** key again. The second existing setpoint will appear. In this example 180 "Off Setpoint" will appear in the display window.



- Press the **Ch On/Off** key to turn the **Channel On/Off** indicator On.
- Press the "+" key to increase the setpoint to 185 as shown below.



- **Press Recall** until each programmed setpoint is verified. Repeat for all channels and all setpoints.

Cam Module Duplication Mode

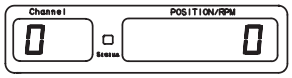
The M1250 Mini•PLS provides a unique and easy method of duplication programs between Cam Modules. This duplication capability allows easy nonvolatile storage of several different Cam Modules for fast program changeovers for different production setups,repeating the same program for different Mini•PLS's.

1. The Cam Module slots are numbered 1 through 5. The first slot is located next to the main terminal block. **(Refer to Illustration 2**)

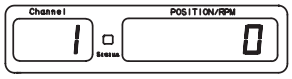
2. The **Origin** slot contains the Cam Module with the "Master" program.
3. The **Copy** slot contains the Cam Module that will receive the "Master" program.
4. Power should always be removed when removing or inserting Cam Modules.
5. You can copy the contents of Cam Modules from any slot to any other slot.

The key sequence for module duplication is as follows:

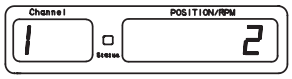
1. Press **the Dup** key. The both Channel and Position windows will display "0".



2. Enter the **Origin** slot number, for example, 1. The Channel Display window " 0" will be replaced by the origin slot number "1."

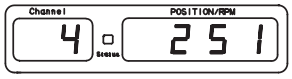


3. Enter the **Copy** slot number, for example, 2. The Position/RPM display window " 0" will be replaced by the copy slot number "2". If you make a mistake, repeat **Step 2.**



If there is no Cam Module installed in **Origin** or **Copy** slot, the unit will go into the error mode. To escape error mode, press the **Dup** key and start over again.

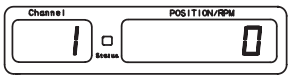
4. Press the **Dup** key. The display will read "0" and then rapidly count up to "1023." If the copy is completely correct, the Mini•PLS will exit to the position mode.



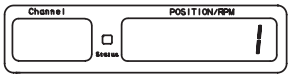
5. In extremely rare instances where the copy is not correct, the Mini•PLS will stop counting at the faulty memory location. An incorrect copy means that the **Copy** Cam Module is faulty. Replace the faulty Cam Module and start over.

Motion Detector Programming

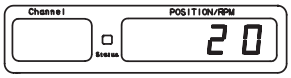
1. Press the **Tach** key. The Position/RPM window will indicate the current shaft RPM and the **Tach** indicator will be illuminated (Machine at rest).



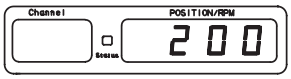
2. To program motion detector setpoints, press **Recall** key. The display will indicate the current Low setpoint.



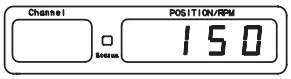
Enter a number between 0 and 1899, for example, 20 RPM for the Low setpoint and press **Tach** key to register it into the memory. If you enter a Low setpoint higher than the High setpoint, you will get an error mode, which can be cleared by pressing the **Tach** key.



3. Press the **Recall** key. The display will indicate current High setpoint:



Enter a number between 1 and 1900, for example 150 RPM for the High setpoint and press **Tach** key to register it into the memory. If you enter the High setpoint lower than the Low setpoint, you will get an error mode, that can be cleared by pressing **Tach** key.



4. While still in tach mode, you can review the motion detector setpoints by pressing the **Recall** key. If desired, the High and Low setpoint can be adjusted and fine-tuned by using "+" or "–" keys.
5. If you try to enter numbers higher than 1900, they will not be accepted by the unit.

Programming the SAC-M1250-0101G Mini•PLS Safety Feature

The **SAC-M1250-010G** Mini•PLS has a special added safety feature that affects Channel 1 only (Channels 2–40 remain standard.) The purpose of this safety feature is to allow Channel 1 to be turned on only within an allowable window, preventing the operator from harming equipment or personnel by accidentally activating the Channel 1 output outside of the allowable angle range. The new definitions are as follows:

1. Only one setpoint pair (ON/OFF) will be allowed for Channel 1. Any attempt to split up an existing pair or add a second setpoint pair will cause an error condition.
2. This allowed setpoint pair must exist within the window of 160–360° inclusive. Any attempt to place a setpoint outside of this window will cause an error condition.
3. In order to prevent duplicating from another cam to cam 2 (which may cause multiple setpoints or setpoints outside of the allowed window), when duplicating from any other cam to cam 1, Channel 1 will be erased (no setpoints), while Channels 2–8 will be duplicated in a normal fashion.
4. For safety reasons, the offset function is not allowed, including the incrementing and decrementing of the offset and the direct entry of the offset. This prevents the operator from placing an offset on the unit that would cause the Channel 1 outputs to be active during the forbidden angles of the machine, thereby compromising the integrity of the machine.
5. The Auto-Zero function is still supported in the normal fashion. The machine must be stopped (RPM = 0) before the Auto-Zero is allowed.

Programming a Channel 1 Setpoint:

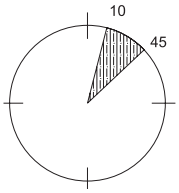
1. Set the scale factor of the unit to 359° (360° per revolution). To enter a setpoint, for example; 160°–358°, ensure that the Programming Enable input is "ON."
2. Press "Chan" then "1" and "Recall." The display should blink ON and OFF with the status light OFF — which means that this channel is OFF for the full 360° of revolution. If not, this setpoint must be erased before the desired setpoint can be entered.
3. Press "Recall" to the beginning of this setpoint-to-be-erased, press "Chan On/Off" until the ON/OFF light extinguishes, then press and the "+" key, erasing each angle of this setpoint-to-be-erased until the status light extinguishes.
4. Press the "Recall" key now and if there are no other setpoints on this channel, the display will flash. Press "Recall" once more to stop the display from blinking.
5. Now that there are no setpoints existing for Channel 1, proceed to enter the new setpoint (160°–358°). Press the "Chan On/Off" key — forcing the chan on/off light to be ON.
6. Press "Angle" and enter "160".
7. Press and hold the "+" key and increment this angle stopping at angle 358°. Using the "Recall" key, the unit will show a setpoint beginning at 160° and ending at 358°.
8. Press "Recall" to recall the 358° setpoint endpoint, press and hold the "+" key. Notice that the incrementing stops at 360°. Use the "Recall" key and note that the setpoint begins at 160° and ends at 000. Now Channel 1 is ON for the full allowable window and no other setpoints may be added.

Reducing or Shortening a Setpoint:

1. If the setpoint needs to be shortened (i.e., 160°–220°), you must start turning off angles from the end of a setpoint (i.e., 360°) and not from the middle of the setpoint (220°), because the unit will not allow the creation of two setpoint pairs (160°–220° and 221°–360°) — see definition 1 on the preceding page.
2. To shorten the setpoint in the previous example, press "Angle" and enter "0." Using the "Chan On/Off" key, turn OFF the chan on/off light. Press and hold the "–" key and decrement the angle stopping at angle 220°. Channel 1 should now turn ON at 160° and turn OFF at 220°.

M1250 Dwell Programming

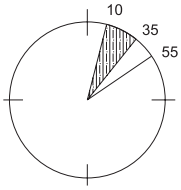
TO ADD ONE DWELL:



Program the PLS to turn ON at 10° and OFF at 45°.

KEYSTROKES:		RESPONSE:
Chan		
1		
Angle		
1	0	
Chan On OFF		Until Chan On/OFF LED is On
+		Repeat until angle = 45
Chan On OFF		Until Chan On/OFF LED is OFF
Recall		Status LED is ON at 10, OFF at 45

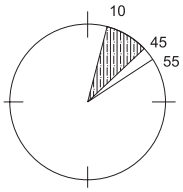
TO SUBTRACT DWELL FROM END OF EXISTING DWELL:



Subtracing dwell from the end of the existing dwell setpoint so that it will be ON at 10° and OFF at 35°.

Chan	
1	
Recall	Until 55 is seen
Chan On OFF	Until Chan On/OFF LED is OFF
-	Repeat until angle = 35
Recall	Status LED is ON at 10 and OFF at 35

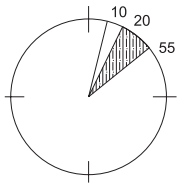
TO ADD DWELL TO END OF EXISTING DWELL:



Adding dwell to the end of the existing dwell setpoint so that it will be on at 10° and off at 55°.

Chan	
1	
Recall	Until 45 is seen
Chan On OFF	Chan On/OFF LED should turn ON
+	Repeat until angle = 55
Chan On OFF	Chan On/OFF LED should turn OFF
Recall	Status LED is ON at 10, OFF at 55

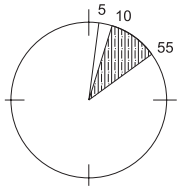
TO SUBTRACT A DWELL FROM FRONT OF EXISTING DWELL:



Subtracting dwell from the front of the existing dwell setpoint so that it will be ON at 20° and OFF at 55°.

Chan	
1	
Recall	Until 10 is seen
Chan On OFF	Chan On/OFF LED should turn ON
+	Repeat until angle = 20
Recall	Status LED is ON at 20 and OFF at 55

TO ADD DWELL TO FRONT OF EXISTING DWELL:



Adding dwell to the front of the exsiting dwell setpoint so that it will be ON at 5° and OFF at 55°.

Chan	
1	
Recall	Until 10 is seen
Chan On OFF	Chan On/Off LED should turn ON
+	Repeat until angle = 5
Chan On OFF	Chan On/OFF LED should turn OFF
Recall	Status LED is ON at 5, OFF at 55

5. M1250 Troubleshooting Guide

System Problem	Check
Unable to program unit. Parameters (Scale factor, Offset, etc.)	—Program Enable (Term. 5) is tied to VS- (Term. 4) —Machine must be at rest, several parameters (Scale Factor, Offset - numerical entry) are locked out if the resolver is turning faster than 3 RPM. —Memory damage due to severe electrical noise. Check grounding and shielding as per manual (may need to send unit in, to replace memory).
Unit parameters program OK, but unable to program Cams.	—Cam Modules are installed **in order** (i.e,. slots 1 & 2 for 2 cams, slots1, 2, 3, and 4 for 4 cams) —Cam Module is **properly seated** in back of unit (not cocked at an angle) —Write Protect jumper on Cam Module is not cut (see section 4.3.5) —Ensure cam module wiring is done with shielded cable and is properly routed —May have to erase channel that is locked up. **Procedure:** Call up channel, turn channel On/Off light to Off. Press “Angle” then enter “O”. Use “+” button and plus to scale factor. Then enter dwell. —Damaged Cam Module — Replace
Cam Module Memory is changing by itself.	Program Enable input is not left enabled — while this will not cause the Cam Module program to change by itself, removing the Program Enable jumper when not actually programming the unit ensures that the Cam Memory cannot be programmed. Sig. Ref. (R1) and Earth Ground **are not** tied together. 1) turn power off to the M1250 2) using and ohm meter, measure from Term. 4 (main terminal block) to Earth Ground. 3) The reading should be higher than 100k ohms. If cams are driving electromechanical relays, then limit transients are below 1000V with suppressors, such as GE MOV V130L10, across electromechanical relay contacts.

System Problem	Check
Position and Tach readings are incorrect.	—Proper grounding and shielding has been applied. —Resolver is correctly wired: 1) Turn power off to M1250 unit 2) With main terminal block connected to unit, measure with an ohm meter the following: a.) Term. 4 to Term. 7 = about 10–50 ohms b.) Term. 4 to Term. 7 = about 10–50 ohms b.) Term. 8 to Term. 10 = about 100–150 ohms c.) Term. 9 to Term. 11 = about 100–150 ohms
Mechanical Zero Drifts.	—Resolver cable is properly grounded and shielded. —Mechanical Resolver linkage is not loose.

6. How to Order

1. Mini•PLS System Components

1.1 *Mini•PLS for front panel mount with* **logic level** *or* **power** *output cam modules:* **Follow steps 2 and 3**.

1.2 *Mini•PLS for front panel mounting with remote Power Relay Output Chassis:* **Follow steps 2, 3 and 4.**

1.3 *Mini•PLS with Remote or Built-in Power Relay Output Chassis: for Back Panel or NEMA 12 Enclosure mounting:* **Follow Step 5.**

1.4 *Position Transducers:*

Following table lists Autotech position transducers for various models of Mini•PLS M1250. Please see position transducer section for How to Order information on these transducers and appropriate accessories.

PLS Model	Transducer
SAC-M1250-010	RL100, E6R, E7R, E8R or RL101 Single turn resolver

2. Mini•PLS

2.1 *Select one of the following Single-Turn Rotary PLS's for front panel mounting . Cam modules or power outputs are not included:*

SAC-M1250-010	3-Digit, single turn, basic unit with input power 105–135 VAC
SSC-M1250-010	Slave unit for M1250 above
SA2-M1250-010	For 220/240 VAC, 50/60 Hz AC power inputs
SAC-M1250-010G	Same as SAC-M1250-010 but with Safety Feature added to Channel 1 Setpoints.

3. Output Modules

3.1 *Select type and number of logic level output cam modules:*

ASY-M1250-08TI	8 TTL output, cam module with terminal block (Replacement for ASY-M1250-08T)
ASY-M1250-08PI	8 PNP output, cam module with terminal block (Replacement for ASY-M1250-08P)
ASY-M1250-08NI	8 NPN output, cam module with terminal block (Replacement for ASY-M1250-08N)

3.2 *Select type and number of power output cam modules*

ASY-M1250-08AC: 8 Outputs, 120 VAC @ 1 Amp each output, 4 Amp max per module.

ASY-M1250-08DC: 8 Outputs, 10–28 VDC @ 1 Amp each output, 4 Amp max per module.

3.3 *Select type and number of special (Position, Tach or communication) modules.*

Notes: Maximum two modules from this category may be used in a PLS.

ASY-M1250-20MAP Analog position/tach module; 4–20 mA current sourcing output.
ASY-M1250-20MAN Above with current sinking output.
ASY-M1250-010V Above with 0–10 V analog output.

ASY-M1250-XXX X X Digital position and Tach output modules

- Output Type
  - **T:** TTL with multiplexing
  - **P:** PNP source transistor
  - **N:** NPN sink transistor
- PC Handshake
  - **1:** With PC sync circuit
  - **0:** Without PC sync circuit
- Output Format
  - **BCD:** BCD position
  - **TAC:** Digital TACH; BCD output

3.4 *Cable for wiring logic level cam or special modules to external devices:*

for ASY-RLYCH-xxxx:

CBL-RLYCH-D04 15 conductor cable,with overall foil shield, 4 ft length and sub "D" connector on one end for interconnection of relay chassis to the PLS

CBL-15S22-DAxx Same as above but for cable length longer than 4 ft. (xx is length in feet)

for ASY-OUTPT-xx:

CBL-18S22-Cxxx 18 conductor shielded cable for use with modules with terminal block (per cam)

4. Remote Power Relay Output Chassis

4.1 *Select type and number of output chassis: (must use NPN type module as per step 3)*

ASY-RLYCH-08SS Chassis for 8 solid-state relay outputs or electro-mechanical SPS T outputs using KSD-A12DC-10AMP relays

ASY-RLYCH-16SS Chassis for 16 solid-state relay outputs or electro-mechanical SPST outputs using KSD-A12DC-10AMP relays

For 220 /240 VAC unit, change the "Y" in ASY to "2"

4.2 *Select type and number of output relays:* (required for ASY-RLYCH-xxx Relay Chassis)

KSD-A12DC-10A	Electromechanical relay, SPST, Form A, 120 VAC @ 10 Amps
KSS-120AC-3AMP	AC solid-state relay, 120 VAC @ 3 Amps
KSS-60VDC-3AMP	DC solid-state relay, 9–60 VDC, 3 Amps
KSS-200DC-1AMP	DC solid state relay, 200 VDC, 1 Amp
KSD-012DC-10A	Electro-mechanical realy, SPDT, 120 VAC @ 10 amps, resistive (For use with ASY-LYCH-08RL and 16RL relay chassis only)5. Mini•PLS with Built-in Power Relay Output Chassis or NEMA 12 (IP52) Enclosure Mounting

5. Mini•PLS with Built-in Power Relay Output Chassis or NEMA 12 (IP52) Enclosure Mounting

5.1.a *Select appropriate system:*

SAC-M1250-XXXX Mini•PLS system for back panel mounting with cam modules, power output chassis and relays

→ Type of power relay outputs:
16RL: 16 EM-relay outputs, 120 VAC @ 10 Amps
16AC: 16 solid-state AC relay outputs, 120 VAC @ 3 Amps
16DC: 16 solid-state DC relay outputs, 9–60 VDC @ 3 Amps
32RL: 32 EM-relay outputs, 120 VAC @ 10 Amps
32AC: 32 solid-state AC relay outputs, 120 VAC @ 3 Amps
32DC: 32 solid-state DC relay outputs, 9-60 VDC @ 3 Amps
40RL: 40 EM-relay outputs, 120 VAC @ 10 Amps
40AC: 40 solid-state AC relay outputs, 120 VAC @ 3 Amps
40DC: 40 solid-state DC relay outputs, 9–60 VDC @ 3 Amps

For 200 VDC solid-state outputs consult factory

5.1.b *Back Panel Mounted /Remote Relay Output Chassis:*

ASY-OUTPT-16XX

→
- RL: Electromechanical relay with 1 NO and 1 NC contact rated at 10 Amp, resistive load at 125 VAC
- AC: Solid-State AC module, 20–135 VAC, 3 Amp maximum load
- DC: Solid-State DC module, 3–40 VDC, 2 Amp maximum load
- AC/DC: Low leakage AC/DC solid-state module, 135 VA C(rms) @ 0.35 Amp or 190 VDC (max) @ 0.5 Amp

5.2. *Select appropriate enclosure, if required:*

ENC-M1250-N16	NEMA 12 (IP52) enclosure for 16 channel PLS
ENC-M1250-W16	Above enclosure with see-through window
ENC-M1250-N32	NEMA 12 (IP52) enclosure for 32 channel PLS
ENC-M1250-W32	Above enclosure with see-through window
ENC-M1250-N40	NEMA 12 (IP52) enclosure for 40 channel PLS

5.3 *Spare Parts:*

EEC-15PIN-0TB	15 position terminal block for main terminal block on M1250 and for cam modules.
MCP-M1250-011	Cover plate for unoccupied cam module space
ECM-15PIN-M11	15 Pin sub “D” male connector 6.

WARRANTY

Autotech Corporation warrants its 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.

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