Autotech Controls
M1950 $I^2 \cdot$ PLS
Die Protection Module
Instruction & Operation Manual

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MAN-M1950-DIE
REV 03 05/11/98

I^2 PLS Introduction

Autotech's I^2 ● PLS™ "integrates with intelligence" to provide an incredibly powerful functional unit which has the capacity for 80 PLS outputs, 40 die protect inputs, 20 load sensors with Signature Analysis or a combination thereof.

Modular Function Flexibility

PLS, Die Protect, or Load Signature modules may be plugged into any of the five back panel slots. Each PLS module can handle 16 outputs, Die Protect Module, 8 inputs and the Load Module can handle 4 sensors in any slot.

Specifications

Number of Inputs	12 (8 Sensor Inputs, 4 Control Inputs), optically isolated; all inputs "P" or "N" type, factory ordered
Number of setups	100 (common to PLS and die protection setups)
Number of Outputs	4 N- Type
E-Stop	To stop press immediately; Fail Safe
Top Stop	To stop press at top; Fail Safe
Quality Counter	Energized when count = 0
Batch Counter	Energized when count = 0
Digital Inputs	
N-Type	
Input True	Switch closure to V_S-, 5.6 mA sink current @ +24 VDC V_S+
Input False	Open circuit or with < .25 mA leakage current
Digital Outputs	
N-Type	
Logic True	Transistor On
Logic False	Transistor Off
Voltage Rating	11-30 VDC
Current Rating	150 mA @ 50° C, 400 mA with 25% Duty Cycle @ 50° C
Voltage Drop Max.	1.1 VDC
Off State Leakage Current @ Vmax.	50 µa
Turn On/Off Time	1 µS
P-Type	
Logic True	Transistor On
Logic False	Transistor Off
Voltage Rating	11-30 VDC
Current Rating	100 mA @ 50° C, 350 mA with 25% Duty Cycle @ 50° C
Voltage Drop Max.	1.8 VDC
Off State Leakage Current @ V max.	200 µa
Turn On Time	2 µS
Turn Off Time	10 µS

Die Protect Module Wiring

Die Protect Terminal Connections

Refer to Illustration 1 to wire the Die Protection Module. All inputs are either sinking or sourcing.

Die Protect Terminal #	Designation	Function/Description
1 - 8	Sensor Inputs	For Die Protection Module (**See DPS Mode and Section DPS1 through DPS4**)
9	Enable Input	When active, Die Protect sensor monitoring is enabled
10	Fault Reset	When true, resets Die Protect faults if there are any
11	Batch Counter Preset	When true, reloads batch counter with its preset value
12	Quality Counter Preset	When true, reloads quality counter with its preset value
13	No Connection	
14	Output Enable	When true, all outputs are allowed to function. When false, all outputs are disabled.
15	Quality Counter Output	Energized when Quality Count is at "0".
16	Batch Counter Output	Energized when Batch Count is at "0".
17	T-Stop	Output for Top Stop detection
18	E-Stop	Output for Immediate Emergency Stop detection
19	Vs+ (11-30 V)	Input from External Power Supply
20	VS- (10 V)	Input from External Power Supply

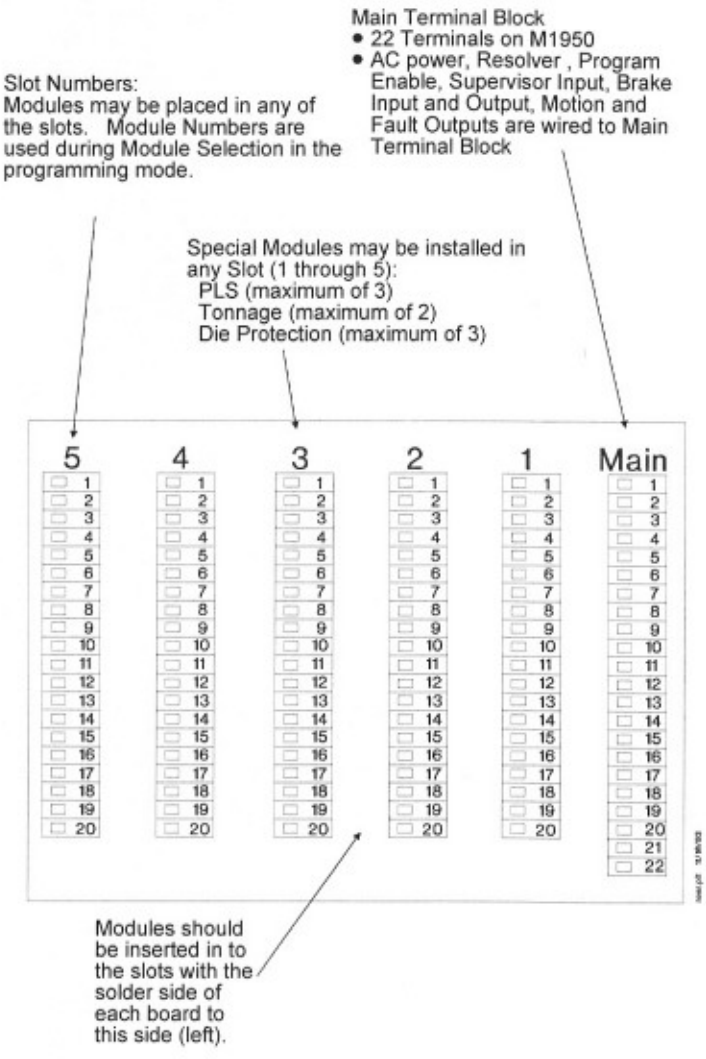

Illustration 1
Rear Module Insertion

Die Protect Module Wiring — continued

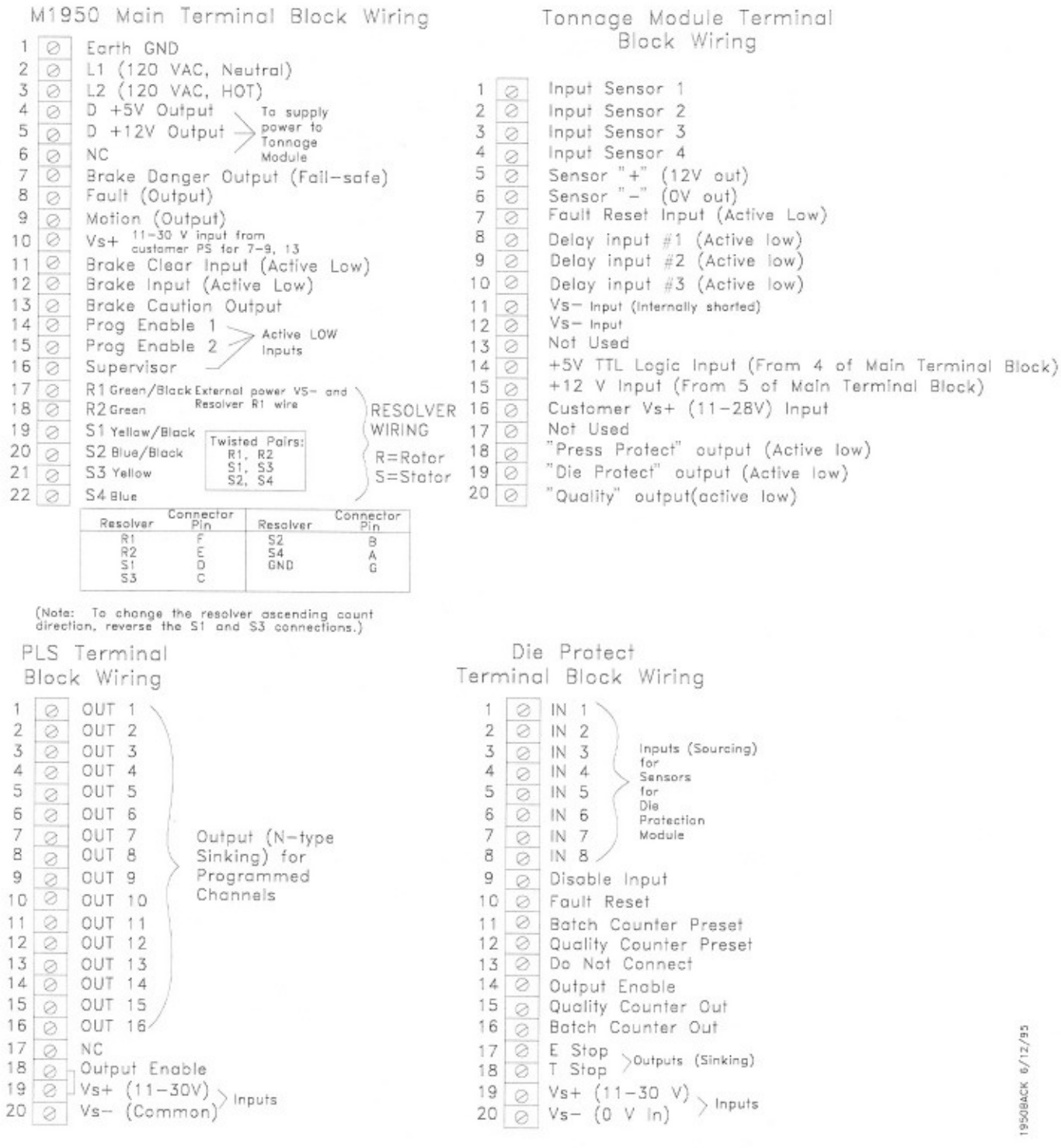

Illustration 2
M1950 Back Panel Wiring

Die Protect Module Wiring — continued

M1950 Main Terminal Block Wiring

1	Earth GND
2	L1 (120 VAC, Neutral)
3	L2 (120 VAC, HOT)
4	D +5V Output — To supply power to Tonnage Module
5	D +12V Output — To supply power to Tonnage Module
6	NC
7	Brake Danger Output (Fail-safe)
8	Fault (Output)
9	Motion (Output)
10	Vs+ 11-30 V input from customer PS for 7-9, 13
11	Brake Clear Input (Active Low)
12	Brake Input (Active Low)
13	Brake Caution Output
14	Prog Enable 1 — Active LOW Inputs
15	Prog Enable 2 — Active LOW Inputs
16	Supervisor
17	R1 Green/Black — External power VS- and Resolver R1 wire
18	R2 Green
19	S1 Yellow/Black
20	S2 Blue/Black
21	S3 Yellow
22	S4 Blue

RESOLVER WIRING

Twisted Pairs:
R1, R2
S1, S3
S2, S4

R=Rotor
S=Stator

Resolver	Connector Pin	Resolver	Connector Pin
R1	F	S2	B
R2	E	S4	A
S1	D	GND	G
S3	C		

(Note: To change the resolver ascending count direction, reverse the S1 and S3 connections.)

Tonnage Module Terminal Block Wiring

1	Input Sensor 1
2	Input Sensor 2
3	Input Sensor 3
4	Input Sensor 4
5	Sensor "+" (12V out)
6	Sensor "-" (0V out)
7	Fault Reset Input (Active Low)
8	Delay input #1 (Active low)
9	Delay input #2 (Active low)
10	Delay input #3 (Active low)
11	Vs- Input (Internally shorted)
12	Vs- Input
13	Not Used
14	+5V TTL Logic Input (From 4 of Main Terminal Block)
15	+12 V Input (From 5 of Main Terminal Block)
16	Customer Vs+ (11-28V) Input
17	Not Used
18	"Press Protect" output (Active low)
19	"Die Protect" output (Active low)
20	"Quality" output(active low)

PLS Terminal Block Wiring

1	OUT 1 — Output (N-type Sinking) for Programmed Channels
2	OUT 2
3	OUT 3
4	OUT 4
5	OUT 5
6	OUT 6
7	OUT 7
8	OUT 8
9	OUT 9
10	OUT 10
11	OUT 11
12	OUT 12
13	OUT 13
14	OUT 14
15	OUT 15
16	OUT 16
17	NC
18	Output Enable
19	Vs+ (11-30V) — Inputs
20	Vs- (Common) — Inputs

Die Protect Terminal Block Wiring

1	IN 1 — Inputs (Sourcing) for Sensors for Die Protection Module
2	IN 2
3	IN 3
4	IN 4
5	IN 5
6	IN 6
7	IN 7
8	IN 8
9	Disable Input
10	Fault Reset
11	Batch Counter Preset
12	Quality Counter Preset
13	Do Not Connect
14	Output Enable
15	Quality Counter Out
16	Batch Counter Out
17	E Stop — Outputs (Sinking)
18	T Stop — Outputs (Sinking)
19	Vs+ (11-30 V) — Inputs
20	Vs- (0 V In) — Inputs

1950BACK 6/12/95

Illustration 2
M1950 Back Panel Wiring

Programming the I^2 PLS for Die Protection

Programming Overview

Autotech prides itself in user-friendly programming — a result of display prompted commands. This manual is provided for the first-time user as a complete reference for understanding the features of Die Protection.

The 20 key keypad and alpha-numeric display are used for programming the I^2●PLS M1950. Programming is menu driven. The display will show several choices. A blinking choice on the display prompts the user to make changes to the value (if necessary). Choices are selected as follows:

- ARROW (RIGHT or LEFT) keys move the cursor selection from one choice to the other. The UP and DOWN ARROW keys are used for programming.
- ENTER key will select and save the choice.
- MODE key is context dependent. This key steps to the next programmable display in the programming sequence or returns to the previous or first screen in the sequence.

The numeric values may be entered in two ways:

- Enter the number directly using number keys; the entry is accepted only after the **ENTER key** is pressed.
- UP ARROW/DOWN ARROW keys to increment or decrement values. Values are modified immediately but the PLS values are not saved until ENTER is pressed.

☞ Before any programming may be done, the Supervisory input and PE (Program Enable) must be TRUE (LOW). (See **System Security** Section of Program Management, **Section 2.2**)

The I^2●PLS M1950 stores up to 100 die setups or programs. Each program can be given a **name** not exceeding 8 characters. A program includes the complete setup information for PLS, Die Protect and Tonnage monitor for a die. When a die is changed in the press, entering the right Die ID will automatically load all the setup information, which has been previously programmed for the Die ID.

Mode Reference Charts

On the I^2●PLS M1950 (referred to as the M1950 throughout this manual) each display is considered to be a different mode. A **Quick Reference Chart**, located at the end of **Section 4,** shows all the modes and transitions between them. However, the detailed descriptions of each mode, displays and key responses, are described throughout this section.

A user will typically follow all or part of the steps when using the M1950. Once the resolver and sensors have been mounted, follow the Setup procedures in **Section 3.4.3.** Setup needs to be done only once for the unit, unless the resolver or sensors are changed. The user also needs to indicate the desired resolution (every degree or every second degree) for profile collection.

Program Management

To manage programs, copy, rename and delete operations are supported. In case of Die Protect inputs, names or labels may be assigned for the inputs for user's convenience.

Security Type	Program Controlled
Program Enable	Required to EDIT all parameters
Supervisor 1	Required for Collect Review (DPS2 & DPS3)

System Security is provided on the Main Terminal Block located on the back of the unit (Terminals 14-16) as Supervisory input or Program Enable. These may be installed as remote "key switches" and must be tied to Vs– for the user to access parts of the system as shown in the previous table.

Die Protection Mode

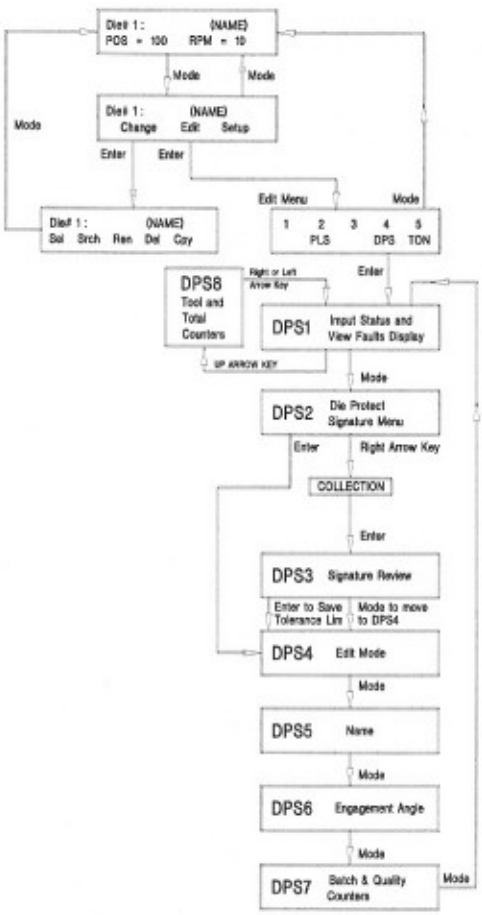

Illustration 3
Die Protection Mode

Front Panel Keys for Module Access

NOTE:
The **GRAY KEYS** — PLS, **Die Protect,** and Counter — are "hot keys" which may be pressed to access either mode at any time.

Pressing the PLS key or Die Protect key will access the Edit Menu Display. If multiple PLS or DPS modules are installed, the user selects which module he wishes to edit. An example of this display is shown below:

1	2	3	4	5
PLS		PLS	DPS	TON

Change, Edit, Setup Program Menu

The Die Protection Module can also be accessed through the EDIT mode of the Change, Edit, Setup Program Menu. When the Default display is viewed, press the **MODE** key to display the **Change, Edit, and Setup Program Menu** This display allows for choosing the programming path to be followed:

- **Change:**
  Changing the Tool#; Searching for a Tool # or name; Renaming, Deleting,or Copying a Die.
- **Edit:**
  Editing the setup program for the optional modules: PLS, DPS, **or TON**
- **Setup:**
  Setting the default LED display, scale factor, offset, motion limits, brake caution and danger limits, and top stop angle.

Key Pressed	Response
ARROW keys	• Moves the cursor from one choice to another. (The changeable option will be blinking.)
ENTER key	• Save the selection
Up and Down Arrow Key or Numerical Keys (For Numerical values: user must ENTER to save)	• Increments or decrements values
MODE key	• Returns to Default Display

Die Protection / Counter Module

Eight inputs are provided on each module for die protection. Any input can be enabled or disabled through the front panel. All inputs can be disabled by applying the external Die Protect Disable signal. Each input can be programmed to cause an E-Stop or T-Stop signal to the press control if a fault occurs.

Die Protect Windows can be either entered manually or a **Die Protect Signature** can be collected automatically. Up to 82 windows can be stored by the unit for all 8 inputs. An extensive library of standard sensor names is provided. Custom sensor names can also be programmed by the user.

In addition, four counters are provided on this module The **Batch Counter** is a presettable counter which counts down strokes. An output signal indicates when zero count is reached. The **Quality Counter** is also a presettable counter that can be set to provide an output to stop the press for parts quality check. Both counters can be preset by external signals. The count is saved at power down. The **Total Counter** counts press cylces regardless of the tool selected. The **Tool Counter** counts press cycles for the selected tool only.

The selection of DPS from the front panel or through Change/Edit/Setup Program Menu (selecting Edit, then DPS) allows the user to program die protection for the press.

Illustration 3 shows the programming sequence in the DPS Mode. An explanation of the displays is shown in **Table 1** on the following page.

Table 1. Die Protect Display Explanation	
Screen Display	*Explanation of Variable*
In	Refers to program Input Sensors 1 through 8. (**Die Protect Terminal Block Connectors 1-8**). Use the UP and DOWN **ARROW** key to scroll through the sensor numbers.
Blow Shrtfeed Missing Buckle Endstock <New> BlnkFeed Transfer AirPress(ure) Oil Press(ure) ClmPress(ur e)OverLoad OverFeed CamDrive HighLoop Oil Level Knockout SlugDet(ect) Thickness Width Misfeed Lube Eject	Predefined names for faults (with the exception of <NEW>). User **Die Protect Terminal Block, Terminal Pins 13 and 14**—E and T Stop Outputs. User is allowed to enter a NEW fault name. Press ENTER. Use the alpha or numeric keys to program the new name. Press ENTER again to accept the new name.
E-Stop T Stop	**Emergency Stop** for any fault detected. Press will stop immediately. **Top Stop** for any fault detected. Press will stop at top stop angle (which user programmed).
F =	Setpoint **From** Angle
T =	Setpoint **To** angle
Rising Falling Pulse InPos Disable	Refer to **Illustration 11.** Within the From and To programmable dwell window which the user programs, the state of each M1950 die cycle can be further analyzed by the M4050 in providing detection for fault outputs.

DPS1 — Input Status Display

```
IN =   1    2    3    4
ST = OFF  ON  OFF  ON
```

The input status display allows the operator to view the ON and OFF status of the 8 inputs. The inputs are viewed in groups of 4: Inputs 1-4 and 5-8. The RIGHT ARROW key is used to toggle between the two groups.

From this display, press the UP ARROW KEY to view the Batch or Quality Count or the DOWN ARROW key to view any FAULTS. **(See the following Counters and Faults Sections)**

DPS7 BATCH AND QUALITY COUNTERS

Upon power up, the saved count is restored. The M1950 provides two actual count down counters: Batch and Quality. Each stroke of the press is displayed while viewing the display. To view this display:

- If only one Die Protect Module is installed, press the GRAY "COUNTER" HOT-KEY on the front panel no more than twice.
- If more than one Die Protect Module is installed, from the DPS1 display, press the **UP ARROW** key .

The first display viewed is:

```
Batch Count= 830208
Qlty Count=  731663
```

- Press the **RIGHT ARROW** key to return to the DPS1 display **OR Press the MODE** key view Tool and Total counters.

DPS8 TOOL AND TOTAL COUNTERS

Upon power-up, the saved count is restored. The M1950 provides two actual count up counters: Tool and Total.

Tool and Total counters are reached from the counters menu by cycling past the Batch and Quality display Mode. Pressing mode again brings up the Clear Total Counter Mode. Pressing mode once more brings up the Clear Tool Counter Mode. The Total Counter counts press cycles regardless of the tool selected. The Tool Counter counts press cycles for the selected tool only. Switching tools automatically stores the current tool counter and loads the new tool counter. Once the Total or Tool counters reach their 8-digit limits, they roll over to zero.

The first display viewed is:

Total Count = 7 6 5 4 3 2 1 Tool Count = 1 2 3 4 5 6 7 8

Press the MODE Key to switch to the Clear Total Counter Screen:

Clear Total Counter? Yes No

Press MODE Key to switch to the Clear Tool Counter Screen or press the ENTER Key to accept selection and switch to the clear Tool Counter Screen.

Clear Tool Counter? Yes No

Press MODE Key to switch to the Batch Set screen or ENTER Key to accept selection and switch to the Batch Set Screen.

DISPLAY AND KEYSTROKE	RESULT
RIGHT ARROW key/LEFT ARROW key	Toggles between Yes/No
ENTER	Accept selection and move to next menu
MODE key	Move to next menu

The display will show:

Batch Set = 48575 New Set= 48575 Enb

The changeable values will flash on the display.

DISPLAY AND KEYSTROKE	RESULT
RIGHT ARROW key	Toggles between numeric value and Enable/Disable
Numerical Value Flashing UP,DOWN ARROW KEY	When value is flashing, press to change values (on display both old and new change)
NUMERICAL KEYS	Changes new value, old remains visible
IMPORTANT: Once numerical keys are pressed, arrow keys may not be used.	

DISPLAY AND KEYSTROKE	RESULT
ENB / DIS Flashing UP, DOWN ARROW KEY	Toggles between Enable or Disable
MODE key	Returns to Batch Count, Quality Count Display

FAULTS

From the DPS1 (Input Status and View Faults Display), press the DOWN ARROW key to view any faults. The following display (example only) will continue flashing if any real faults are present. The "E" represents "error", "4" refers to the Module Slot number in which the error is occurring. (Refer to the M1950 Installation and Operation Manual "Module Insertion in Rear of M1950" illustration for Slot Number and Module identification information)

The fault may be cleared or viewed as follows OR press the MODE key to exit and not clear any faults):

☞ TO VIEW AND CLEAR THE FAULT:

Press the **DOWN ARROW** key to view where the fault is occurring. The following display will appear :

In 3 NAME at POS <ENTER> to clr fault

Press **ENTER** to clear the fault and return to the status display. If there is more than one fault occurring, the first fault will clear, the second or successive faults will be displayed. Continue pressing **ENTER** to clear all faults.

Press the **MODE** key to move to the next display.

☞ TO REMOTE RESET FAULTS

The Fault Reset Input (Terminal 10 on the Die Protection Module) may be wired to a switch for remote reset of any faults.

INCH MODE

The die protect functions disabled are identical to those disabled by disconnecting the die protect enable wire on the terminal block. Counters and E-Stop/T-Stop are disabled. Quality and Batch counters cannot be reset during inch mode since they cannot be reset with the die protect enable wire disconnected. E-

Stop/T-Stop can be reset in inch mode and will remain active while inch mode is enabled. E-Stop/T-Stop must be reset in inch mode by the fault reset input. Resetting the fault from the front panel clears the faults but leaves the E-Stop/T-Stop outputs de-energized. This is the same as removing the die protect enable wire.

DPS2 —Die Protect Signature Menu

```
Die Protect Signature
Edit   Rev   Collect
```

☞ ***Please Note that the use of DPS2 Menu may cause all the counters in the Die Protection Module to count -- each time the menu is used!***

Press the MODE key while viewing the Input Status Display. The above- display will appear.

"EDIT"

"Edit" allows modification of the Die Protect parameters manually. Press **ENTER** to move to the DPS4 mode.

"REV"

To revise the Signature Review Collection Input Setup, press the **RIGHT ARROW** to move the cursor to "**REV**". Press **ENTER**. The following display will appear:

```
In3  <NAME>
W1 F=  o   T= o
```

Press the **RIGHT ARROW** key to move between Input number and Window.

Press the **MODE** key to modify the parameters. The following display will appear (example only):

```
IN3  <NAME>   T-Stop
W1  F= 20  T= 39  RISE
```

Screen Display	***Explanation of Variable***
In	Refers to program Input Sensors 1 through 8. (**Die Protect Terminal Block Connectors 1-8**). Use the UP and DOWN **ARROW** key to scroll through the sensor numbers.
See DPS 5 for names <NEW>	Predefined names for faults (with the exception of <NEW>). User is allowed to enter a NEW sensor name. Press ENTER. Use the alpha or numeric keys to program the new name. Press ENTER again to accept the new name.
E-Stop T Stop	**Emergency Stop** for any fault detected. Press will stop immediately. **Top Stop** for any fault detected. Press will stop at top stop angle (programmed by the user- See SET8). **Die Protect Terminal Block, Terminal Pins 17 and 18**—E and T Stop Outputs.
W#	Window and Window number (1 or 2)
F = T =	Setpoint **From** Angle Setpoint **To** angle
NOTE: Second press of RIGHT ARROW key while cursor is on T# flashes both the F & T # for simultaneous programming.	
Enable Disable	Enables or disables input for die protection

Press the **MODE** key to return to the DPS2 menu.

"COLLECT"

Press the **RIGHT ARROW** to move the cursor to **"Collect"**.

```
Die Protect Signature
Edit    Rev     Collect On
```

"Collect On" will appear in the display when the when the cursor is placed on "Collect".

The M1950 is capable of learning automatically about die protect sensor status during a single stroke. During this one stroke the Die Protection Signature is collected. Press **ENTER** to Collect and SAVE.

```
IN 1 '
W1  F= o   T= o
```

DPS3 — Signature Review

☞ The "ALPHA" key on the front panel toggles between the EDIT MODE (DPS4) and the REVIEW MODE (DPS3).

```
In 1   <NAME>
W1  F= o    T=  o
```

When the Signature is saved, the Review Mode is automatically entered. This mode allows the user to review the collected information.

For example, suppose Input 1 had a positive transition at 10° and negative transition at 35° . (These transition points are the average over eight strokes.) If any transitions occur outside of the above-mentioned ranges, a fault output will be generated as long as the input monitoring is enabled.

☞ All the inputs are enabled for die protection monitoring right after the signature is collected.

To view multiple windows on the same channel, move the cursor to W1(Window 1) with the RIGHT ARROW key and press the UP ARROW key.

The next window will come up if there is any. If no additional windows are available, "o" will replace the numbers in the F (From) and T (To) fields on the display..

If an input had been low while the Signature was collected, "o" will appear for that input right away. If an input had been high all the time when the Signature was collected, "ALL" will appear in F (From) and T (To) windows.

DPS4 — Edit Mode

☞ The "ALPHA" key on the front panel toggles between the EDIT MODE (DPS4) and the REVIEW MODE (DPS3).

This display is interpreted as follows:

```
IN 1 '        E-STOP
W1 F= 10  T= 35  Enable
```

Top Row:

- Input 1
- ' : Press the UP ARROW to view names
- Type of Output (may be programmed as an E-Stop or T-Stop activation in case of a fault caused by this input).

Bottom Row: This row will show a Window (within the "From angle, To angle" defined tolerance limit). If a window is not present or if the press is in the wrong portion of the cycle, a fault output may be generated, if enabled.

- Window number
- From angle, To angle
- Enable, Disable, Rise, Fall, Pulse, PosHi, or PosLo if fault is detected

DPS5 — Name

There are several predefined fault names which may be selected:

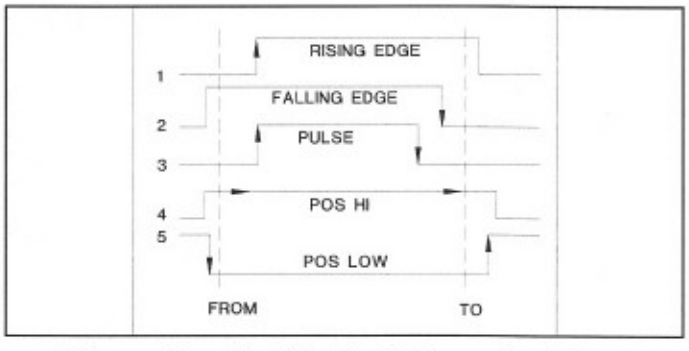

Illustration 4 - Die Fault Detection Types

Misfeed	EndStock	CamDrive
Lube	BlnkFeed	HighLoop
Eject	Transfer	OilLevel
Blow	Air Press(ure)	Knockout
Shrtfeed	Oil Press(ure)	Slug Det(ect)
Missing	ClmPress(ure)	Thickness
Buckle	OverLoad	Width
	OverFeed	<New>

Programming a "New" name is similar to changing the tool or die name. Move the cursor to "NEW" on the display. Press ENTER to move to the next display.

SLUG DETECT DELAY

If any sensors are name " SlugDet(ect)" another mode will come up on the display:

Slug Det Fault Delay Stroke Old = 55 New=55

The "NEW" value programmed into this display refers to the number of strokes that will be present before a fault output is activated. If this fault is removed before the stroke count expires, the fault output will not be activated.

Key Pressed	Response
RIGHT ARROW key	• Moves to next field or character
UP / DOWN ARROW key	• Increments or Decrements Values
	• Scrolls library of names
	• Scrolls through alpha characters when programming the "new" name
NUMERICAL keys	• Change numerical values
ENTER key	• Saves program
MODE key	• Moves to next display

DPS 6 — Engagement Angle

If a fault occurs between the programmed engagement angle and the bottom of the press (180°) an E-Stop will not be generated until the press moves past 180° prevent die lockup.

Engagement Angle Old = 140 New = 120

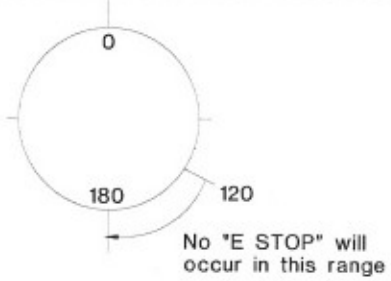

Illustration 5 - Engagement Angle

Key Pressed	Response
UP, DOWN, numerical	Change values
MODE key	Move to DPS1

When a direction change of less than 4-5 degrees is detected, the outputs will remain unchanged as if this direction change did not take place.

How to OrderPart Number

SAC-M1950-010	M1950 Base Unit — No modules
ASY-M1950-DP	Die Protect Module — 8 inputs

Optional Accessories

Remote Power Relay Output Chassis

ASY-RLYCH-08RL	Chassis for 8 EM-relay outputs with motion detector output and built-in power supply.
ASY-RLYCH-16RL	Same as above only with 16 EM-relay output
ASY-RLYCH-08SS	Above chassis for 8 solid-state relay outputs
ASY-RLYCH-16SS	Above chassis for 16 solid-state relay outputs

Relay Chassis Accessories

CBL-15S22-DAXXX	15 conductor cable, with overall foil shield, xxx feet length and sub "D" connector on one end. Length ordered must be 10, 25, 50, and in 50 foot increments.
KSD-012DC-10	10 AMP, SPST EM relay
KSS-120AC-3AMP	3 AMP, 120 VAC, solid-state AC module
KSS-60VDC-3AMP	3 AMP, 9-60 VDC, solid-state DC module

Warranty

WARRANTY

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