Autotech Controls
M2020 Absolute Position
Die-Set Control
Instruction & Operation Manual

AUTOTECH CONTROLS
343 St. Paul Blvd.
Carol Stream, IL 60188

Telephone: 708/668-3900

Fax: 708/668-0341

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M2020 Absolute Position Die-Set Control

Instruction Manual

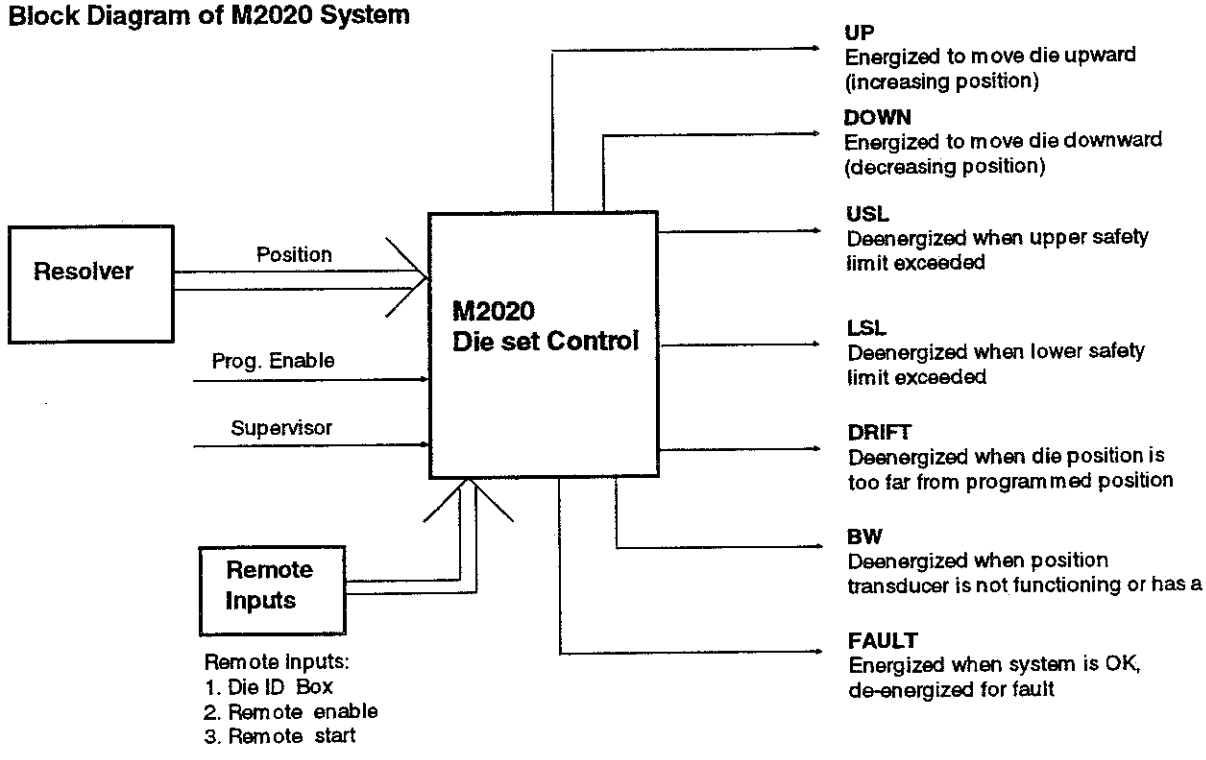
1. Introduction

The M2020 Series Die-set control is a state-of-the-art microprocessor-based system for automatic die positioning on single and dual-action metal forming presses. A functional block diagram of M2020 system is shown below. The M2020 reads die position from a resolver, and activates proper outputs to move die to programmed position automatically. It generates outputs if programmed safety limits are exceeded, or certain fault occurs.

The M2020 system can store die-set information for 255 different single-action or dual-action dies. During die change-over, the operator can enter a particular die number or die name and press the front-panel < **Auto**> and < **Start**> buttons to initiate the automatic die positioning sequence. The M2020 senses the die position and adjusts the shut height to the preprogrammed position. An automatic anti-backlash routine is built into the die-set program so that the shut height motor will always approach the programmed position from the same direction. For better precision, a programmable correction factor may be entered for each die so that the control motor will shut off in time to allow the die to coast to a stop at the desired shut height. For maximum precision, the motor can be pulse width modulated starting at the distance equal to correction factor above the programmed position.

With the alphanumeric LCD display and 20-key keyboard, the M2020 programming is quick and easy to understand. The operator is assisted in the programming process by English prompts and messages.

Block Diagram of M2020 System



The following information required for M2020 operation includes press-specific and die-specific parameters:

Press specific parameters include:

- Die Number selected
- Scale Factor, automatically computed in calibration mode
- Upper Safety Limit
- Lower Safety Limit
- Pulse On Time
- Pulse Off Time
- Drift Limit
- Two Calibration Points for automatic calibration.

Die specific parameters include:

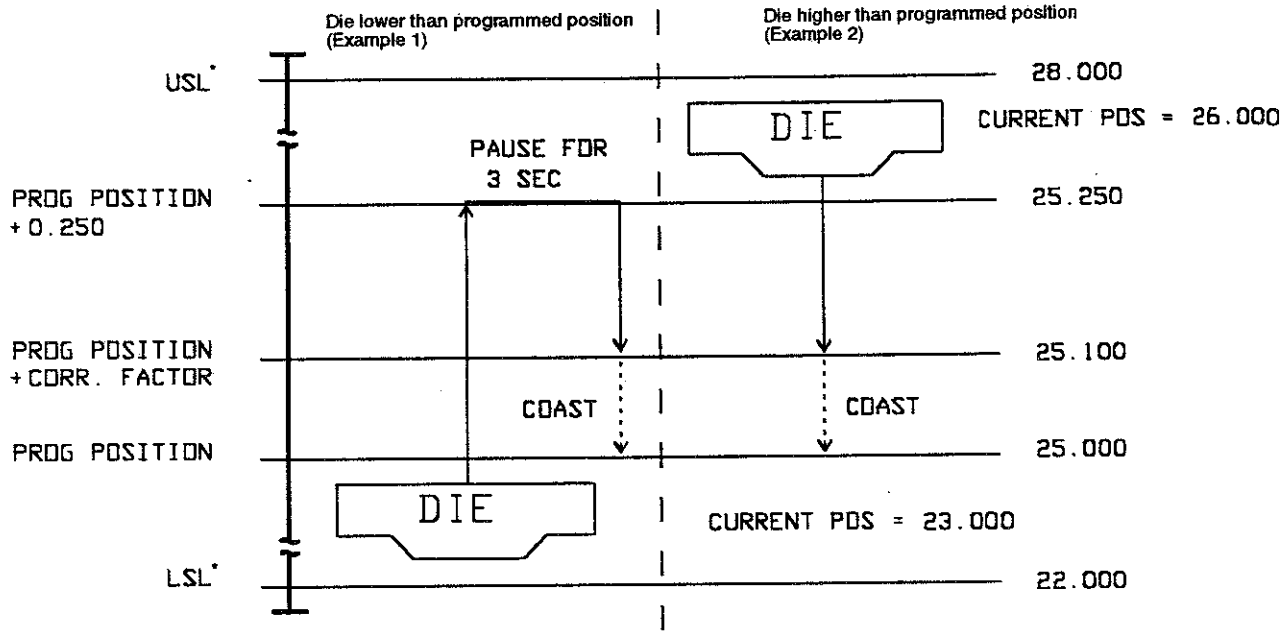
- Die Number
- Die Name, 12 alphanumerical characters
- Programmed Position
- Correction Factor

To understand automatic die-set function, read the following examples and refer to diagram in **Figure 1.**

Example 1 (die lower than programmed position):
If the Programmed Die-Set Position is 25.000 inches, and the current die position is physically too low, the die will be moved to about 1/4 inch above the programmed position, pause for 3 seconds, and then descend to the die-set position. If pulse high and low times are programmed as zeroes, the motor will be turned off at programmed position + correction factor. It will then coast until it comes to a full stop. If pulse times are different from zeroes, the motor will be pulsed according to the programmed parameters starting at programmed position + correction factor. When programmed position is reached, pulsing stops.

Example 2 (die higher than programmed position):
If the die begins in a position more than 1/4 inch too high, then only the second part of the positioning sequence will be executed (the part following the pause).

Automatic Die-Set Function (Figure 1)



2. Specifications

Input Power:

105-135VAC, 50/60HZ, 35W exclusive of load
(220VAC or 240VAC option)

Operating Temperature:

-10° F to 130° F (—23° C to 55° C)

Input/Output

Program Enable:

Contact closure to customer power supply common (Vs—); or a solid-state sinking output with less than 0.8V drop at 10mA

Supervisor Enable:

Contact closure to customer power supply Vs+ ; or 10 to 28V logic input, (sourcing output)

Logic false: 4VDC @ 1mA and

Logic true: 10VDC @ 10 mA to 28VDC @ 30mA

Outputs:

All outputs NPN sinking, 30VDC max, @ 100mA.

Autotech offers a compatible relay output chassis that can be used for power outputs.

UP: Energized to move die upward (increasing position)

DOWN: Energized to move die downward (decreasing position)

USL: Deenergized when upper safety limit exceeded

LSL: Deenergized when lower safety limit exceeded

DRIFT: De-enegized when die position is too far from programmed position

BW: Deenergized when position transducer is not functioning or has a broken wire

Fault: Fault output **Energized** only when system is functioning properly, i. e.:

- Power is OK
- Resolver or Linear is OK
- Processor is OK

It is **Deenergized** when there is fault in the system.

Remote Inputs:

Die Number via Die ID Box

8 bit binary (Die Number 1 to 255 decimal)

Contact closure to customer power supply Vs+ ; or 10 to 28V logic input, (sourcing output)

Logic false: 4VDC @ 1mA and

Logic true: 10VDC @ 10 mA to 28VDC @ 30mA

Remote and Start Inputs:

Contact closure to customer power supply common (Vs—); or a solid-state sinking output less than 0.8V drop at 10mA

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

Cam Module required : N type with a DB 15 connector.

Cable: Prewired with DB15 connector on both ends.

Relays: Relay chassis is available for EM or Solid state relays.

Electromagnetic relays (Part# KSD—012DC—10A):
120 VAC @ 10 Amp, SPDT

Solid State AC relay (Part# **KSS-120AC-3AMP**):
24—280VAC @ 0.2—3 Amp, zero cross-over switching triac output relay,optically isolated

Solid State DC relays

*Part# **KSS-60VDC-3AMP:***
9—60VDC @ 3 Amp, optically isolated

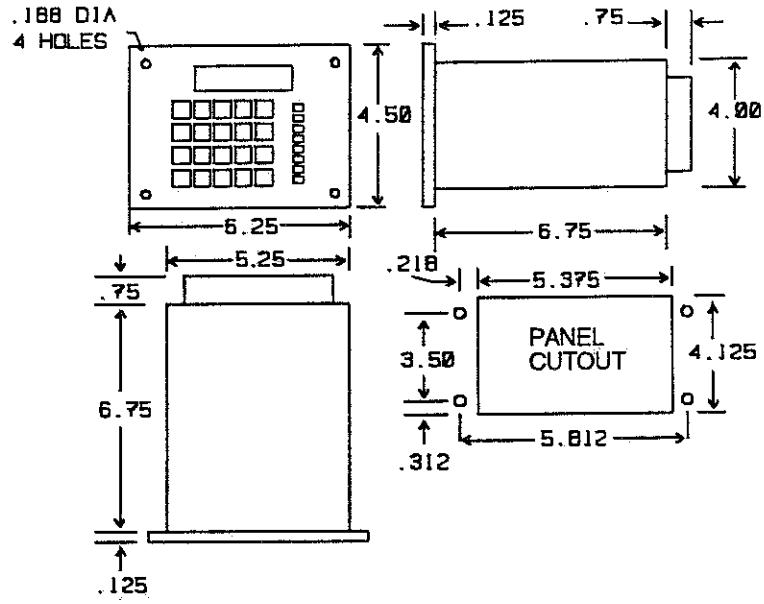
*Part# **KSS-200VDC-1Amp:***
0—200VDC @ 1Amp, optically isolated

3. Installation

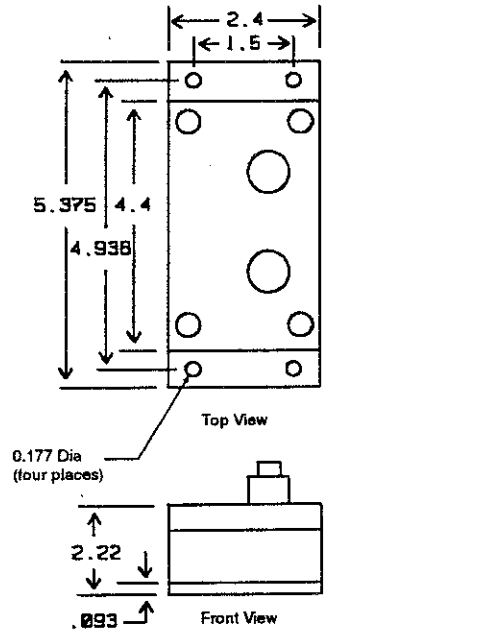
3.1 Mounting Dimensions (See figures below)

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 & four 6-32 screws) are provided for mounting. For 8 Outputs Relay Chassis and Die ID Mounting details, refer to figures shown below.

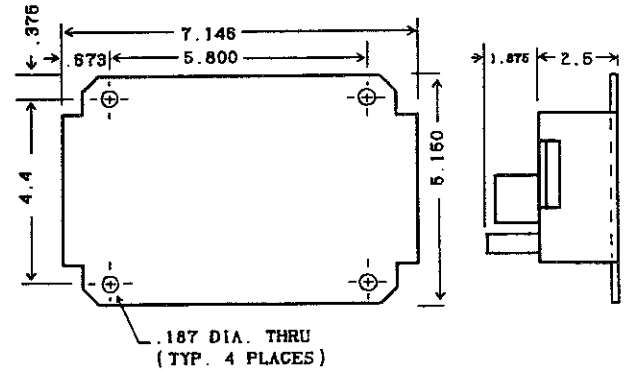
Front Panel Mount



Die ID Mounting Dimensions

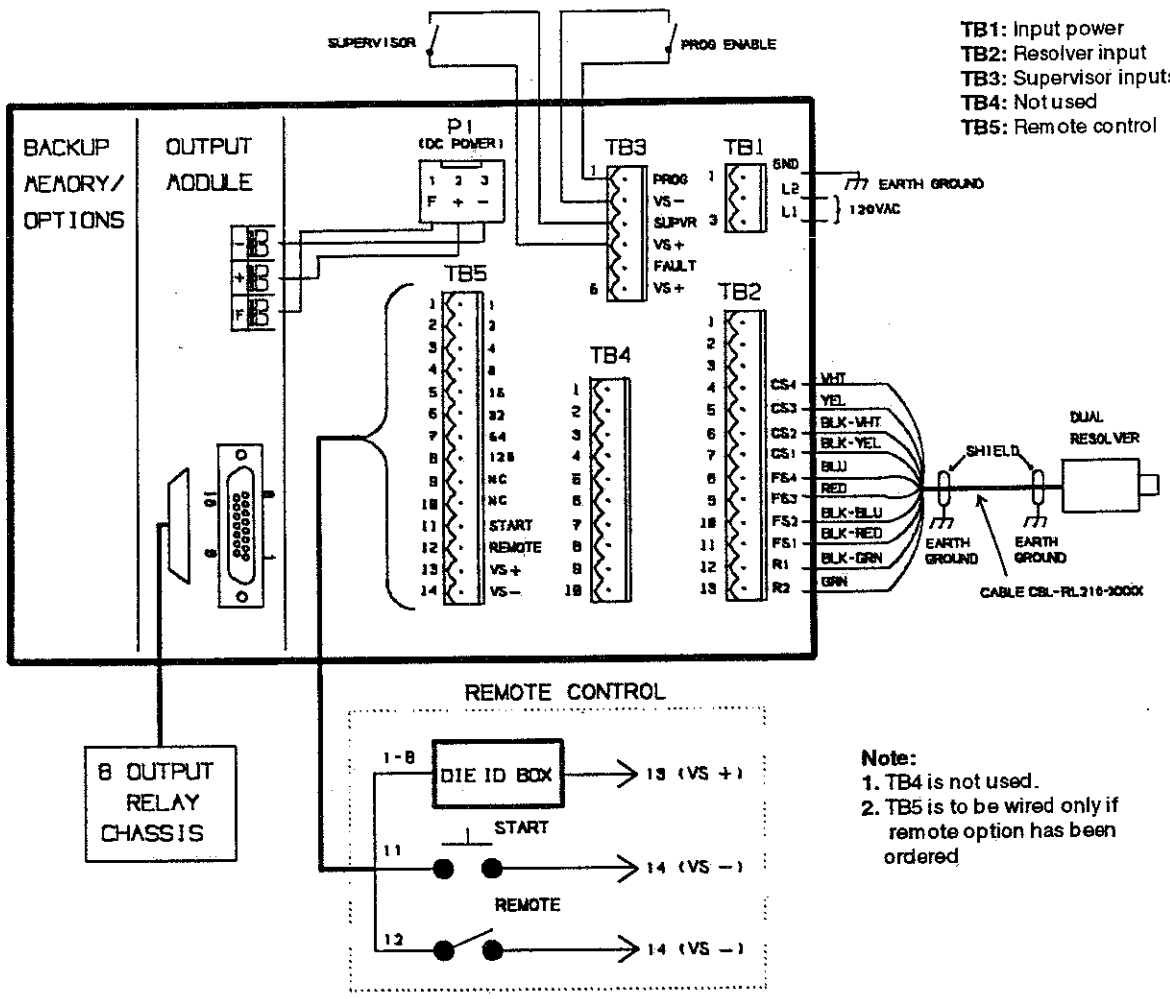


8 Outputs Relay Chassis (ASY-RLYCH-08xx)



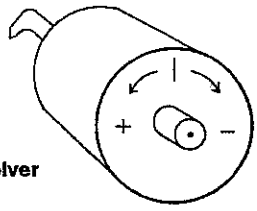
3.2 Wiring Diagram

3.2.1 Back Panel Wiring



Note:
1. TB4 is not used.
2. TB5 is to be wired only if remote option has been ordered

IMPORTANT



Resolver

For proper operation of Die-set Control, the displayed position should decrease when die is in downstroke. This is achieved by making sure that the resolvers are wired correctly. Autotech's resolvers increase in position, while turning counter clockwise (CCW), and the wiring is done as shown in the table.
If Die-set Control displays increasing position, while die is moving downward (e.g. if resolver is turning CW), change the wiring as follows:

Swap CS1 and CS3
Swap FS1 and FS3

Resolver Wiring Information

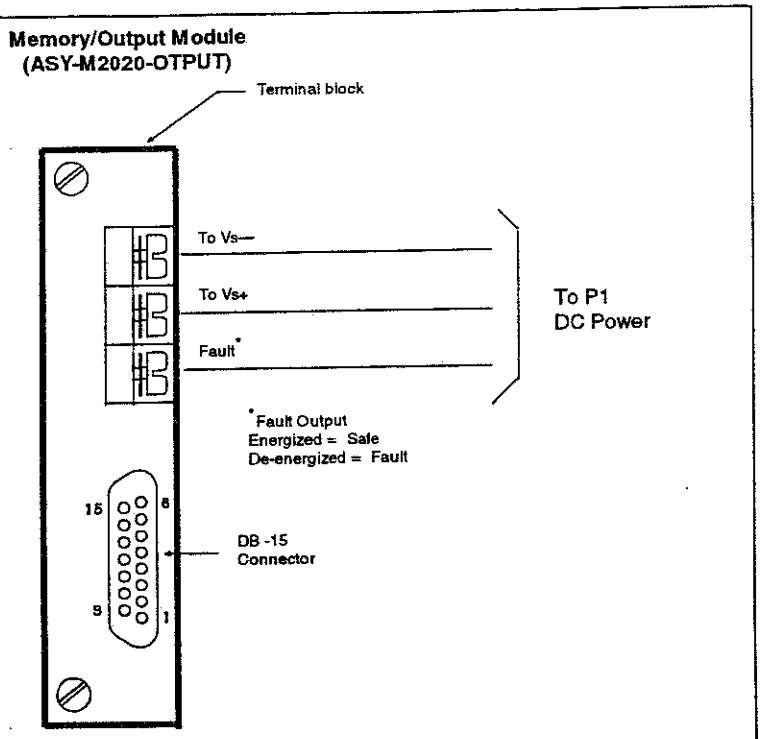
Resolver Terminal Number	TB2 Terminal pin #	Cable wire color CBL-RL210-xxxx	Signal
1	12	Black/Green	R1
2	13	Green	R2
3	7	Black/Yellow	CS1
4	6	Black/White	CS2
5	5	Yellow	CS3
6	4	White	CS4
7	11	Black/Red	FS1
8	10	Black/Blue	FS2
9	9	Red	FS3
10	8	Blue	FS4
Green Screw		Shield	Case ground

3.2.2 Output Wiring

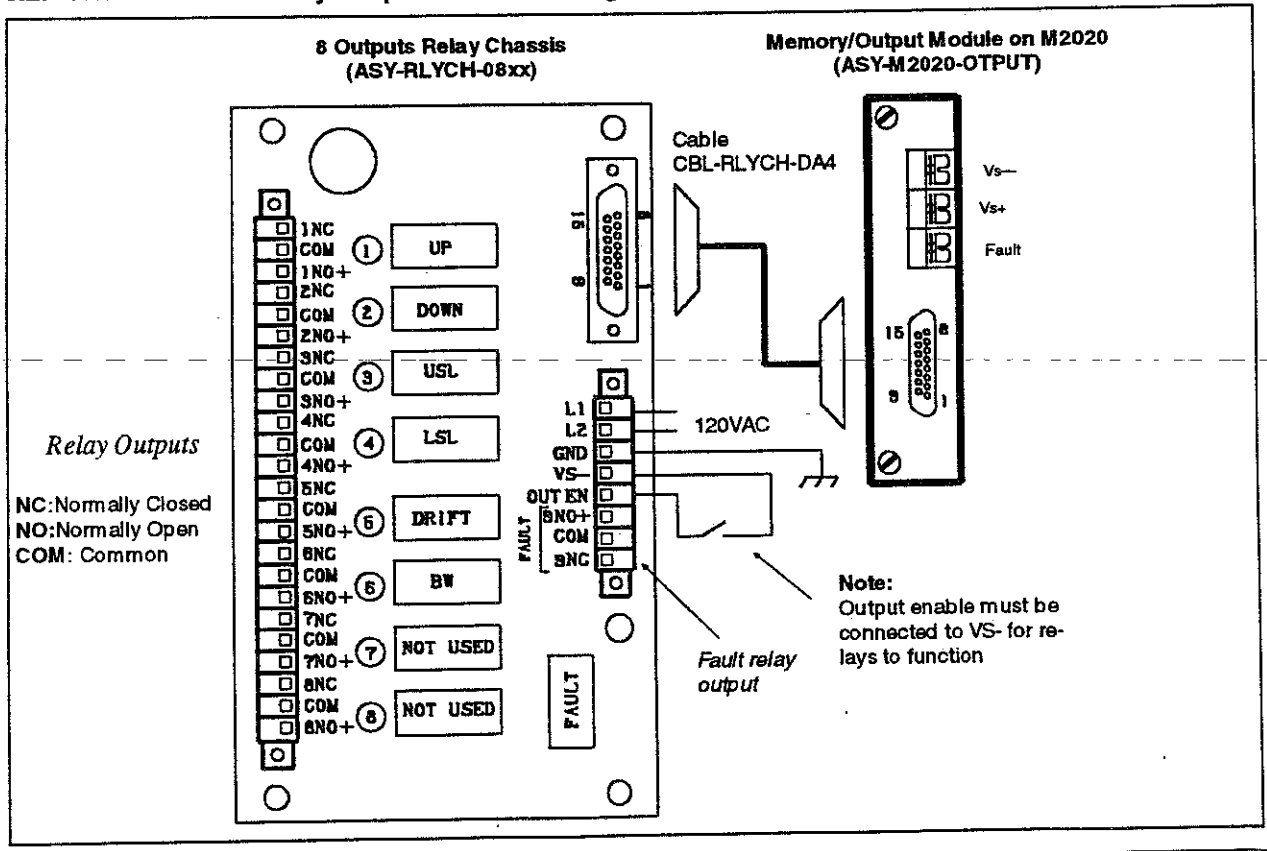
Pin definitions for DB-15 connector on Cam modules (Cable: CBL-15S22-DAxxx)

Pin #	Cable color	Function
1	Black	NC
2	White	Vs— (SigRef or Com)
3	Red	Vs+ (50VDC max for P&N; 5VDC max for T)
4	Green	Fault
5	Orange	N/C
6	Blue	Drift
7	White/Black	USL
8	Black/Red	Up
9	Black/Green	Vs—
10	Black/Orange	Vs+
11	Black/Blue	Output Enable
12	White/Black	N/C
13	White/Red	BW
14	White/Green	LSL
15	White/Blue	Down

NC : Not Connected;

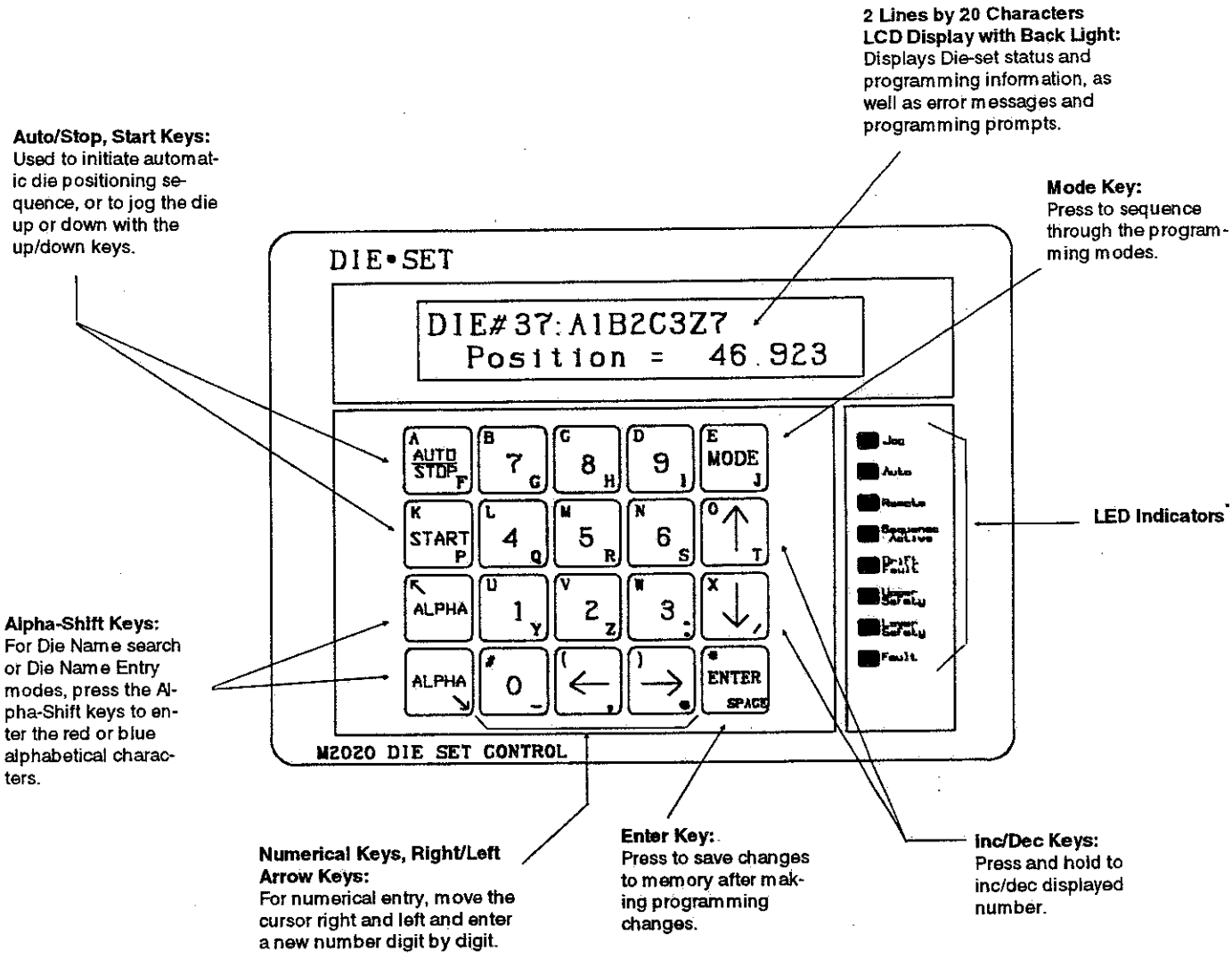


3.2.3 Remote Power Relay Output Chassis Wiring



4. Programming

4.1 M2020 Front Panel and Key Controls



LED Indicators:

Status LEDs:

Jog - On when jogging the die up or down from the keyboard.
Auto - On when Auto-sequence mode is selected and waiting for a < start> keypress.
Remote - On when the Remote Control Inputs are enabled and a valid die number is selected.
Sequence Active - Flashes when the Die-set routine is actively positioning the die.

Fault LEDs:

Drift Fault - On when die position is beyond Drift Limit (+ /-) from the Programmed Position.
Upper Safety - On when Upper Safety Limit has been exceeded.
Lower Safety - On when Lower Safety Limit has been exceeded.
Fault - On when a system fault is detected.

4.2 Programming Sequence

To prepare the M2020 for proper operation, the following parameters must be programmed in.

Press specific parameters include:

- Die Number selected
- Scale Factor, automatically computed in calibration mode
- Upper Safety Limit
- Lower Safety Limit
- Pulse On Time
- Pulse Off Time
- Drift Limit
- Two Calibration Points for automatic calibration.

Die specific parameters include:

- Die Number
- Die Name, 12 alphanumerical characters
- Programmed Position
- Correction Factor

Program Enable and Supervisor Inputs (TB3):

Program enable and supervisory inputs on terminal TB3 must be properly wired. Before program changes are started, the following points should be noted:

- For die-specific parameters, only the **Program Enable** needs to be on.
- For press-specific parameters, both the **Program Enable** and the **Supervisor Enable** must be on.

The press-specific parameters are considered more critical for safe and proper operation. For programming **Program Enable and Supervisor Enable must be on** for these parameters. A flashing right-arrow prompt will appear when programming of a parameter is allowed, if the arrow prompt is not visible, then the parameter may only be viewed. After all programming changes have been made, it is a good idea to turn off the Program Enable input. This input is an electrical interlock that will prevent unauthorized program alteration as well as memory corruption from high-energy electrical interference.

If there is ever a parameter which is too large a value to be displayed, an overflow indication "ov" will replace the arrow prompt. Since this parameter is probably an erroneous value, it should be edited to make sure it is within safe limits.

Numerical Editing:

All numerical values are edited in a similar manner and the following is a description of the editing functions available. Words or symbols in angle brackets "< ?> " indicate that the named key should be pressed. This is the convention used for the manual and for the prompts on the M2020 display.

If the Right-Arrow Prompt is Visible and Flashing...

Increment number:
Press the < **up arrow**> key to increment the displayed number. Hold the key down for repeated incrementing.

Decrement number:
Press the < **down arrow**> key to decrement the displayed number. Hold the key down for repeated decrementing.

The < **Enter**> prompt will be visible after changes have been made, and the < **Enter**> key must be pressed to save the changes.

The < **Mode**> key may be pressed at any time before the < **Enter**> key to abandon the changes made to the displayed number.

To make large changes to numbers, edit the number digit by digit using the following procedure:

Press the < **right arrow**> key to place the blinking block cursor at the first digit of the number to be changed.

Use the < **right arrow**> and < **left arrow**> keys to move the blinking block cursor to the digit to be changed.

Press a < **number**> key to overwrite the number at that position. The cursor will automatically move one place the the right and be ready for changes at the next digit.

Press < **Enter**> to save the changes, or press < **Mode**> to abandon the changes.

Values outside of the specified ranges will not be stored, and the M2020 will display a message as shown below to indicate the error.

```
Too High
```

OR

```
Too Low
```

Setting up the M2020:

When M2020 is powered up, it comes up in the position monitoring mode.

Pressing < **Mode**> key will change the display to the mode selection menu.

```
Select Mode: 1)Press
2)Die 3)Other 4)Exit
```

Press < **1**> key for press specific parameters.

Press < **2**> key for die specific parameters

Press < **3**> key for duplication mode.

Press < **4**> key to return to the position monitoring mode.

The operating parameters for the M2020 should be entered in the following order:

Press-specific Parameters must be determined first!

1. Upper Safety Limit - USL, must be larger than the LSL.
2. Lower Safety Limit - LSL, must be smaller than the USL.
3. Pulse On Time.
4. Pulse Off Time.
5. Drift Limit, less than 0.250 inches.
6. 1st Calibration Point, must be between Safety Limits.
7. 2nd Calibration Point, must be between Safety Limits also.

Die-*specific Parameters 1 to 255 may then be entered.*

1. Select Die Number or Die Name Search.
2. Edit Die Name, 12 alpha-numerical characters (may be blank).
3. Programmed Position, must be in the range: (USL - 0.250) to LSL.
4. Correction Factor, must be less than 0.250 inches.
5. Change Die Number and continue programming individual die set-ups, or double check entered values and begin operations.

Press Specific Parameters:

Scale Factor:

For programming inputs PROG & SUVPR must be on.

Note: It is very important to use the Auto-Calibration sequence to determine the value of the Scale Factor for the first time. The operator should only use the "Scale Factor" mode for two purposes:

1. To view the Scale Factor and verify that the Auto-Calibration has been successful.
2. For resolver based units only! To make only minor adjustments to the Scale Factor if the known value differs slightly from the Auto-Calibration value. If the Scale Factor is changed in this way, the operator must realign the resolver to the 1st Calibration Point only.

For the resolver based M2020, the Scale Factor is in units of inches of travel per revolution of the resolver shaft.

For the linear rod, the calibration number printed on the rod (about 9.0000 µsec/in) is the number displayed for the Scale Factor.

Upper Safety Limit (USL) and Lower Safety Limit (LSL):

For programming inputs PROG & SUVPR must be on.

The Safety Limits define the maximum and minimum safe positions for the die movement under M2020 control, and the M2020 will not sequence or jog the control motor outside of these limits. The Safety Outputs will be triggered if a safety limit is exceeded.

1. Press the < **Mode**> key to display:

```
Upper Safety Limit
```

2. Edit and < **Enter**> the Lower Safety Limit value.
3. Press the < **Mode**> key to display:

```
Lower Safety Limit
```

4. Edit **and** < **Enter**> the Upper Safety Limit value.

Pulse On Time

For programming inputs PROG & SUVPR must be on.

To achieve a greater precision in positioning, the control motor can be pulsed instead of being run continuously once a certain distance (correction factor) above programmed position is reached. The user has an option of setting the values for the Pulse Width Modulation as required by a particular application.

1. Press the < **Mode**> key to display:

```
Pulse On Time (Sec)
```

2. Edit and < Enter> the Pulse On Time value.

Pulse Off Time:

For programming inputs PROG & SUVPR must be on.

1. Press the < **Mode**> key to display:

2. Edit and < Enter> the Pulse Off Time value.

```
Pulse Off Time (Sec)
```

Drift Limit:

For programming inputs PROG & SUPVR must be on.

The M2020 constantly monitors the die position and triggers the Drift output if the measured die position drifts too far away from the Programmed Position in either direction. The drift limit must be in the range, 0.000 to 0.250.

1. Press the < **Mode**> key to display:

2. **Edit and** < **Enter**> the Drift Limit value.

```
Drift Limit (+/-)
```

Automatic Calibration:

For programming inputs PROG & SUPVR must be on .

To enable quick calibration of the M2020 for accurate operation, follow the following two-step procedure:

1. **1st Calibration Point:**
   a. Move the Die to a known position near one end of it's travel, but still within safety limits.
   b. Press the < **Mode**> key to display:

```
Move to 1st Point
```

   c. Enter the value of the known position and press < **Enter**> . If the number has already been entered, just press < **Enter**> again to re-calibrate the position to that exact point
   d. The display will announce that the position has been calibrated.
   e. Now go on to step 2 if full calibration is desired. or, quit now if transducer realignment is all that is needed (if full calibration has previously been done, and no scaling or display offset adjustment are needed).
2. **2nd Calibration Point:**
   a. Move the Die to a known position near the other end of it's travel, but still within safety limits. The farther apart the Calibration points are, the better.
   b. Press the < **Mode**> key to display:

```
Move to 2nd Point
```

   c. Enter the value of the known position and press < **Enter**> . If the number has already been entered, just press < **Enter**> again to re-calibrate the position to that exact point.
   d. The display will announce that the position has been calibrated. The M2020 is now scaled and calibrated for the machine to which it is attached.

Die-Specific Parameters 1 to 255:

Each of the 255 die setups consist of the following parameters:

1. Die Name, 12 alpha-numerical characters.
2. Programmed Position.
3. Correction Factor.

There are two ways of selecting the current die setup:

1. Select die by number.
2. Die name search, pattern matching with wild-card character.

Select Die Number:

1. With Program Enable on, Press the < **Mode**> key to display:

```
Select Die Number
```

2. Edit the new die number, or press the < **up/down-arrow**> keys to increment or decrement the die number, and then press < **Enter**> .

Die Name Search:

Entering characters into the 12 character alphanumeric die name or search pattern is similar to the digit-by-digit numerical editing described above, except that the < **Alpha**> shift keys are used to access the color coded alphanumerical characters printed on the upper-left (**red**) and lower-right (**blue**) corners of the keys. The process is to first press one of the < **Alpha**> keys and then to press the key on which the character appears. Numbers are typed in directly without the < **Alpha**> key. When an < **Alpha**> key has been pressed and the keyboard is ready for an alpha character, the prompt will change from a blinking block to a blinking inverse "A". If the wrong < **Alpha**> key was pressed, just press the other one. To undo the **Alpha** prompt, just press the same < **Alpha**> key again to toggle back to a normal blinking block cursor and cause the unit to expect a < **number**> key to be pressed next.

With Program Enable on, Press the < **Mode**> key to display:

```
Die#???:************
Die Name Search < >
```

The search pattern consists of 12 alpha-numeric characters. The search pattern may be edited to locate a whole or partial die name when the corresponding die number is not known.

1. Type in alpha-numeric characters that are known to be part of the die name. Unknown characters may be replaced with a "*", which is the wild-card character and will match anything.
2. Press < **up-arrow**> to begin searching for a matching die name. If a match is not found, the display will say so. If a match is found, the die number and name will be displayed.
3. Press < **Enter**> to change to this die number/name, **OR**
4. Press < **up-arrow**> again as needed to continue matching die names until the desired name is located, **OR**

5. Press < **down-arrow**> to recall the search pattern for editing and to begin searching with a different search pattern
6. The < **Mode**> key can always be pressed to abandon this mode.

Edit Die Name:

Once the Die Number has been selected either by number or name, the die name may be edited or left blank. Use the same alpha-numerical editing procedure as outlined above to edit the die name.

1. With Program Enable on, Press the < **Mode**> key to display:

```
Edit Die Name
```

2. Edit the new die Name, and then press < **Enter**> .

Programmed Position:

The Programmed Position is the desired position of the die while parts are being produced, and must be in the range:

(USL - 0.250) to LSL.

1. Press the < **Mode**> Key to display:

2. Edit and < **Enter**> the Programmed Position value.

```
Programmed Position
```

The difference between programmed positions must be at least:

Interference limit + 2 Outer correction factor

If this provision is not observed, an automatic sequence will not run.

Correction Factor:

The Correction Factor meaning depends on the values of pulse on time and pulse off time programmed.

1. If both times are set to zero, the correction factor is the distance the die will coast in the downward direction after the control motor has been turned off.
2. If pulse on time and pulse off time are different from zero, the correction factor is the distance above the programmed position at which pulsing of the control motor starts.

The Correction Factor must be less than 0.250 (inches). If this may be done safely, the Correction Factor for the first case may be determined by temporarily setting the Correction Factor to 0.000 and sequencing the die-set. The amount of over-shoot (Programmed Position minus current Die Position), is the value that should be entered for the new Correction Factor.

1. Press the < **Mode**> key to display:

```
Correction factor
```

2. Edit and < **Enter**> the Correction Factor value.

Version, Hardware and Checksum:

When the unit is working at the default screen (Die Number/Name and Position), press < **Enter**> to display the Version, Hardware, and Checksum information for this unit. This information can be used by Autotech service personnel to assist the customer with any questions he may have about the installation, programming or operation of the M2020. The M2020 continues to operate normally while this information is being displayed. Press the < **Mode**> key to return to the normal display.

Backing up the memory in the M2020:

All programmed values in M2020 are stored on it's memory/output module (ASY-M2020-OTPUT). These values can be duplicated in a similar module for back up purposes.

In case of problem, the back up module can be used to restore the program in M2020. To back up/restore the M2020, follow below given steps.

This process overwrites the destination module with the information from the source module. The previous information in the destination module is lost permanently.

1. With the power off, insert the Backup Memory Module in the "option" slot of the M2020 and tighten the screws.

2. Turn the power back on, turn on the Program Enable and the Supervisor Enable.

3. Press the < **Mode**> key to go to the select mode menu:

4. Press < **3**> key. The following screen will appear.

```
Duplicate Module
Master ? Backup
```

5. Press the < **right-arrow**> key to select copying from the Master module to the Backup module, the following screen will appear, or

```
Duplicate Module
Master -> Backup
```

6. Press the < **left-arrow**> key to select copying from the Backup module to the Master module. The following screen will appear.

```
Duplicate Module
Master <- Backup
```

7. Press < **Enter**> **when you are sure that you intend to overwrite all of the information on the destination module with the information on the source module, OR**

8. Press < **Mode**> to abandon this process.

The display will show the progress of the copying process as the number counts down from 255 to 1 and then checks to make sure the data were copied correctly.

5. Operation

IMPORTANT

For proper operation of Die-set Control, make sure that the displayed position increases for upward movement of the die. If displayed position is decreasing, check resolver wiring and consult wiring section.

There are two modes of operation for the M2020, Automatic and Remote. Automatic mode is controlled from the front panel keyboard; Remote mode is controlled by the optional Input module which might be connected to a Die ID Box and switches.

Automatic Mode:

For automatic mode, the Die Number must be selected before beginning. Within automatic mode there are two operations available:

Jogging up and down, and

Automatic sequencing.

To sequence or jog the die from the M2020 front keyboard, press the < **Auto/Stop>** key. The display shows the Die Number, Die Name and the Die Position. It also prompts for the user to press the < **Auto>** key again or to jog the die position.

To jog the die position, press the < **up-arrow>** or < **down-arrow>** keys.

Using the < **up arrow>** key will move the die upward.

To run the die positioning sequence, press the < **Auto>** key a second time and then press the < **Start>** key to start the sequence. The die positioning sequence is as described in the introduction section of this manual (see **Figure 1**). If the M2020 detects that sequencing the die would cause the die position to exceed safety limits, the sequence will not run. If this happens, carefully check the Safety Limits, Programmed Position and the other parameters to make sure that they are in safe ranges. Press the < **Mode>** key at anytime to exit Auto mode and return to the default display.

Remote Operation:

Remote operation consists of three parts:

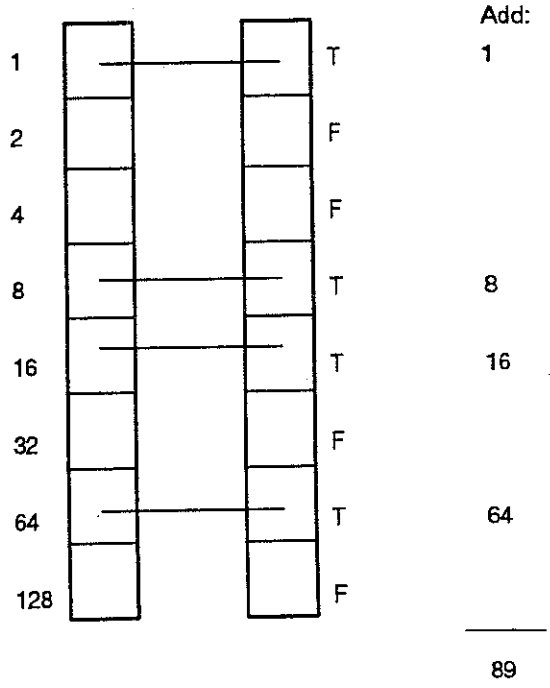
1. Die Number Selection via ID Box (8 bit binary)
2. Remote Control Enable (key switch)
3. Start Trigger Input (push button)

The Die Number should be selected before enabling the **Remote** input. If a different die number is being selected, the Program Enable must be on. When the **Remote** input is turned on, the Die Number selected by the Die ID Box will override the Die Number previously stored in the M2020. The new number will be stored and the front panel Remote light will go on. At that point, the **Start** input may be triggered, and if the parameters are ok, the sequence will start. The front panel keyboard will be locked out during remote operations.

Die ID Box Option:

A Die ID Box may be attached to each die to ensure that the proper die number program is selected.

The Die ID Box contains 8 wiring terminals that are either left open or wired closed to select a die number, see diagram below:



LED Indicators:

Status LEDs:

Jog - On when jogging the die up or down from the keyboard.
Auto - On when Auto-sequence mode is selected and waiting for a art keypress.
Remote - On when the Remote Control Inputs are enabled and a valid die number is selected.
Sequence Active - Flashes when the Die-set routine is actively positioning the die.

Fault LEDs:

Drift Fault - On when die position is beyond Drift Limit (+ /-) from the Programmed Position.
Upper Safety - On when Upper Safety Limit has been exceeded.
Lower Safety - On when Lower Safety Limit has been exceeded.
Fault - On when a system fault is detected.

System Faults include:

1. Position Transducer not hooked-up or not functioning
2. Memory/Output Module not installed
3. AC power loss
4. Processor Reset

The Fault LED will turn on and the Fault Output will de-energize until the fault is fixed. Sequencing will be disabled or aborted in this event.

6. How to Order

6.1 Complete system:

SAC-M2020-S128	Single die-set control system, consisting of 1 output card, power output chassis with 4 relays, interconnecting cable (4 feet) and one resolver RL210 (128 : 1 gear ratio), resolver cable not included
SAC-M2020-S128R	Above with remote control

6.2 System components:

SAC-M2020-010	Single die-set control, basic unit without any I/O's, resolver or cable
ASY- M2020-INPUT	Input card, 12 optically isolated inputs (needed for remote input only)
ASY-M2020-OTPUT	Output card, 8 outputs
ASY- RLYCH-08RL	Chassis for 8EM-relay outputs
ASY-M2020-DIID	Die ID Box
KSD-012DC-10A	EM relay, SPDT, 120VAC @10 Amps resistive
SAC-RL210-G128*	Dual Brushless resolver, multi-turn, NEMA 13, 5/8" shaft dia. *Terminal connection standard, add suffix M for MS Connector
CBL -RLYCH-DA4	15 conductive cable with overall foil shield, 4 feet length and sub "D" connector on both ends for interconnection to the relay chassis
CBL-10T22-Mxxx	22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, with 10 pin MS connector (ECM-10REC-ITT) on one end, required to connect Die ID Box. *Lengths in feet* Standard lengths are 010, 020, 050 feet and increments of 50 feet (Ex. 100,150, 200, etc.)
CBL-RL210-Mxxx	22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, with 19 pin MS connector (ECM-19REC-ITT) on one end *Lengths in feet* Standard lengths are 010, 020, 050 feet and increments of 50 feet (Ex. 100,150, 200, etc.)

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