# HSL-WI5
# APM Bodymaker
# High Speed Front End
# User's Manual

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# WARNING

To ensure the equipment described by this User Manual, as well as the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. This includes the National Electric Code in the USA and other applicable legislation, regulations, and codes in practice elsewhere. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standards and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

Persons supervising and performing installation or maintenance must be suitably qualified and competent in these duties, and should carefully study this User Manual and any other manuals referred to by it prior to installation and/or operation of the equipment.

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The contents of the User Manual are believed to be correct at the time of printing; however, no responsibility is assumed for inaccuracies. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or it's performance or the contents of the User Manual without notice.

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# SECTION 1
# GENERAL DESCRIPTION

This section describes the features of the HSL-WI5. This includes a functional description, alarms detected and a description of the interlocks between the HSL-WI5 and the existing control system.

## 1.1 FEATURES

- Performs the high-speed control functions of the APM Bodymaker to speeds in excess of 500 CPM. This includes clutch control, cupfeed control, air strip control and short can detection.

- Rapid response control of clutch/brake system for emergency stops die protection) as well as precise BDC stops. The clutch solenoid outputs of the HSL-WI5 are not intended as safety contacts for the bodymaker clutch and must not be the only interrupt to the clutch solenoids.

- Accurate short can detection to a resolution of 1/4" can length.

- Highly repeatable air strip control to reduce can stripping and blow out problems.

- Reliable timed cupfeed control to insure proper cup loading and protection from misloads.

- Brake Wear compensation (Auto BDC timing programming) algorithm to stop press at BDC regardless of brake response. Brake response determination allows displaying of actual brake response (in degrees). Brake response alarm to indicate when brake-stopping response (in degrees) has exceeded user preset limit.

- Trimmer speed reference (0-10volt analog output) provides reference to trimmer proportional to speed of bodymaker (user scalable).

- Alarm detection: short can detection, die sensor fail alarm, timing signal fail detection, clutch output failure detection, no ram motion alarm, resolver failure detection, and brake response too long alarm.

- Data Acquisition: Total number of good cans produced and total number of short can faults (for both current shift and last shift).

- Built-in 2 Line X 40 character sealed display with 24 key membrane keypad allows local viewing of collected data (good can count, short can count, brake response) and set-up of all user variables (key switch enabled).

- Interfaces directly with the machine-mounted resolver, short can sensor, flywheel motion sensor and all clutch, cupfeed, and air strip solenoids.

- Based on the high performance M4500 PLC/PLS module, that allows easy trouble-shooting and user customization using SYSdev program development software.

- Built-in PLS provides all machine timing, eliminating need for an additional PLS.

## 1.2 FUNCTIONAL DESCRIPTION

The HSL-WI5 bodymaker high-speed logic module is an electronic upgrade for the APM bodymaker that performs the high-speed control functions including: rapid response clutch/brake control, accurate short can detection, reliable cupfeed and precise air strip control. In addition, the brake wear compensation feature automatically adjusts the BDC timing signals to stop the press at BDC regardless of brake stopping time.

Alarm detection is provided including:

- Short Can Detection
- Die Sensor Failure Detection
- Timing Signal Failure
- Brake Response Too Long Alarm

Data collection includes (both for the current shift and previous (last) shift):

- Total Good Can Count
- Short Can Faults Count

Interfaces directly to:

- The Machine Mounted Resolver
- Short Can Sensor
- Clutch/Brake Solenoids
- Cupfeed and Air Strip Solenoids
- Host PLC via Discrete DC I/O.

## 1.3 CLUTCH CONTROL

The clutch solenoids are activated by the HSL-WI5 through the electro-mechanical two-hand control circuitry provided externally by the user. The throughput of the HSL-WI5 is 0.5 milliseconds. This fast throughput, along with a fully integrated PLS, allows extremely fast and repeatable de-clutching/braking response to be achieved.

Outputs from the host PLC to inputs of the HSL-WI5 control the clutch solenoids. The detection of any alarm (short can fault, die sensor failure, etc.) will result in an immediate de-clutch of the solenoids.

The M4500 incorporates a built-in PLS which interfaces directly with the machine-mounted resolver and provides all machine timing, eliminating the need for an external PLS.

Six discrete DC inputs to the HSL-WI5 are used to control the clutch:

1. “Clutch ON (IMED)”
2. “Clutch ON (BDC)”
3. “Run Mode (not Bar)”
4. “Continuous Mode”
5. “Single Mode”
6. “Inch Mode”

**Note:** The “Clutch ON (IMED)” and “Clutch ON (BDC)” inputs must be turned “ON” simultaneously (within 0.5 seconds) in order for the clutch to activate.

### 1.3.1 CLUTCH CONTROL VIA HOST PLC

The following description of operation defines the requirements of the host PLC logic to activate the clutch through the HSL-WI5:

**Continuous Mode:** Continuous mode is selected when the "Run Mode" and "Continuous Mode" inputs are ON and the "Single Mode" and "Inch Mode" inputs are off. Turning both the "Clutch ON (IMED)" and "Clutch ON (BDC)" inputs ON simultaneously will activate the clutch.

**BDC Stop:** To perform a BDC stop, turn the "Clutch ON (BDC)" input off while leaving the "Clutch ON (IMED)" input ON.

**Immediate Stop:** To perform an immediate or emergency stop, turn both the "Clutch ON (BDC)" and "Clutch ON (IMED)" inputs off simultaneously. This will indicate to the HSL-WI5 that the clutch should be disengaged immediately and not wait for the BDC timing signal.

**Single Mode:** Single mode is selected when the "Run Mode" and "Single Mode" inputs are ON and the "Continuous Mode" and "Inch Mode" inputs are off. Turning both the "Clutch ON (IMED)" and "Clutch ON (BDC)" inputs ON simultaneously for 5 to 50 milliseconds will activate the clutch and the press will make one stroke.

**Inch Mode:** Inch mode is selected when the "Run Mode" and "Inch Mode" inputs are ON and the "Continuous Mode" and "Single Mode" inputs are off. Turning both the "Clutch ON (IMED)" and "Clutch ON (BDC)" inputs ON simultaneously will activate the clutch as long as both inputs are ON.

**Bar Mode:** Bar mode is selected when the "Run Mode" input is off. Turning both the "Clutch ON (IMED)" and "Clutch ON (BDC)" inputs ON simultaneously will activate the clutch will activate the clutch as long as both inputs are ON.

Refer to the schematic at the back of this manual for typical HSL-WI5 clutch connections.

# SECTION 1
# GENERAL DESCRIPTION

**IMPORTANT SAFETY WARNING –**
The HSL-WI5 is intended as a high-speed logic gate to provide consistent and accurate clutch control. It is not designed as a redundant, dual-processor clutch brake safety module.

The HSL-WI5 must not be the only means of controlling the clutch mechanism. Good design practice dictates the use of safety interlocks on any device that starts or stops automatically that can cause personnel injury to operating or maintenance personnel.

The HSL-WI5 must be used only in conjunction with industry approved safety interlock contacts, implemented in accordance with ANSI B11.1 safety requirements; otherwise, serious personnel injury may result.

## 1.4 CUPFEED SOLENOID CONTROL

The HSL-WI5 provides control for both the cupfeed ON and off solenoids. For auto operation, the cupfeed is enabled by the host PLC via a discrete input to the HSL-WI5. The cupfeed is timed ON and off with the cupfeed timing signal to provide accurate cup loading. The manual cupfeed input is provided to activate the cupfeed as long as the manual input is ON.

**Control Of Cupfeed Solenoid Via Host PLC:** Two discrete DC inputs to the HSL-WI5 from the host PLC are used to control the cupfeed solenoid:

1. "Cupfeed Auto Enable"
2. "Cupfeed Manual"

The following description of operation defines the requirements of the host PLC logic to activate the cupfeed through the HSL-WI5:

**Cupfeed Auto Mode:** In single and continuous modes, the cupfeed is gated ON with the leading edge of the cupfeed timing signal (CH04) and gated off with the trailing edge of the cupfeed timing signal. The cupfeed is opened after two strokes when the "Cupfeed Auto Enable" input is turned ON and the leading edge of CH04 occurs. This allows three strokes of air strip to clear the punch of coolant before the first can is made. The cupfeed is closed when the "Cupfeed Auto Enable" input is turned "off" and the trailing edge of CH04 occurs.

**Note:** It takes two strokes once the cupfeed is opened for the first can to travel through the positive cupfeed and is punched. Once the cupfeed is closed, it requires two strokes to punch the last two cups, which are in process of traveling through the positive cupfeed.

**Manual Mode:** The cupfeed can be activated directly (manually) by activating the "Cupfeed ON Manual" input. With the machine stopped, activating the "Cupfeed ON Manual" input opens the cupfeed. When the "Cupfeed ON Manual" input is off, the cupfeed is closed. With the machine running, activating the manual cupfeed feeds one cup with the corresponding three strokes of air strip prior to making the cup.

## 1.5 AIR STRIP CONTROL

The HSL-WI5 provides a repeatability of 0.5 milliseconds for the air strip thus reducing can stripping and blow out problems. Both an "Air Strip (Low)" and "Air Strip (High)" timing signal are provided to activate the air strip two stokes prior to the cupfeed open (when the press is running).

## 1.6 BRAKE WEAR COMPENSATION

The HSL-WI5 incorporates a brake wear compensation or automatic BDC timing feature. This stops the press at BDC regardless of the actual braking response of the clutch/brake. This is accomplished by automatically adjusting the BDC timing signal based on the previous stopping response. Any overrun is detected and a new BDC timing signal is computed such that the machine will stop at the desired location on the next stop. Two BDC signals are provided, one for "Continuous/Single" modes and one for "Inch" mode. The appropriate BDC timing signal is adjusted based on the mode of the machine when a BDC stop is initiated.

The actual brake response (in degrees) is calculated. This is the number of degrees from where the clutch was de-activated (BDC timing location) to the position where the crankshaft actually stopped. This can then be displayed on the Keypad/Display to determine the condition of the brake.

A "Brake Response Too Long" alarm is generated when the actual brake response exceeds a user specified maximum allowed brake response. This can be used to indicate that service to the brake should be performed.

## 1.7 ALARM DETECTION

The HSL-WI5 detects the following additional alarms:

**Short Can Detection:** The "Short Can Check" timing signal (CH02), along with the machine mounted short can sensor, is used to verify the entire length of the can. The short can sensor must see can the entire time the "Short Can Check" timing signal (CH02) is ON. If the can is short (tear off) or any void is detected, the short can alarm is generated and the cupfeed is immediately closed. The resolution of the short can check is 0.5 milliseconds. At a machine speed of 250CPM, this translates to approximately 1/4" resolution in can length. The "Short Can" alarm output must be interlocked to the existing control system to dis-engage the clutch immediately.

**Die Sensor Failure:** This alarm occurs when the short can sensor fails ON. The "Sensor Check" timing signal (CH03) is used to verify that the short can sensor does indeed turn off when a can is not present.

**Timing Signal Fail:** The timing signal fail occurs when any of the timing signals generated in the PLS section fail to change state periodically while the machine is running. This alarm activates the "Can Sensor/Timing Fail" output.

**Brake Response Too Long:** The "Brake Response Too Long" alarm is generated when the actual brake response exceeds a user specified maximum allowed brake response. This can be used to indicate that service to the brake should be performed.

The above alarms are available to the host PLC via discrete outputs. These should be used to stop the machine and indicate the problem when any one of the alarms occurs.

## 1.8 INTERLOCKS TO EXISTING CONTROL SYSTEM

In addition to the alarms listed in section 1.7, the following (+24VDC discrete signals) should be interlocked to the existing control system:

**Clutch ON:** This signal is provided to the host PLC to indicate when the clutch solenoids are ON.

**Pulse Train (3-PPS):** This pulse train signal gives three pulses per stroke. It is provided to the host PLC to check for ram motion once the clutch solenoids have been engaged.

**Logic Sync (CH07):** This signal will provide the host PLC with one pulse per stroke. It is based on the state of timing channel CH07 (PLC Clock Timing). It is generally set for 180 degrees on, 180 degrees off.

**Flywheel at Bar Speed:** This signal is provided to determine flywheel zero speed. This output is set when there is no motion detected by the main crank resolver.

**Flywheel at Inch Speed:** This output is set when the RPM of the resolver is above the bodymaker Low Speed threshold set-point.

**Flywheel at Punch Speed:** This output is set when the RPM of the resolver is above the bodymaker High Speed threshold set-point.

**Cupfeed is Open:** This signal is provided to the host PLC to indicate that the cupfeed is open and the bodymaker is in production.

## 1.9 INTERLOCKS FROM EXISTING CONTROL SYSTEM

In addition to the clutch control interlocks described in section 1.3 and the cupfeed control interlocks described in section 1.4, the following interlocks should be provided by the existing control system:

**End Of Shift:** This signal is used transfer the “Current Shift” data to the “Last Shift” data.

**Alarm Reset:** This signal is used to reset the alarms generated by the HSL-WI5.

## 1.10 DATA COLLECTION

The following data is collected for both the current shift and the previous (last) shift:

1) Total number of good cans produced
2) Total number of short can faults

This data can be viewed locally on the Keypad/Display. This information is updated ("current" shift transferred to "Last" shift) based on the change of state of the "End of Shift" input.

# SECTION 2
# INSTALLATION

The HSL-WI5 module is provided for door mounting on the existing user's control cabinet door or console.

## 2.1 WHAT'S INCLUDED

Verify that the following items are included when unpacking the HSL-WI5 (back-panel mounting):

1ea. HSL-WI5 back-panel for mounting in existing control cabinet (includes the following):

- 1ea. M4500 PLC/PLS Module with required I/O boards
- 1ea. P4500 Power Supply
- 1ea D4591 Display with ribbon cable for mounting in the existing control cabinet door
- 1ea. HSL-WI5 User's Manual
- 1ea. M4500 User's Manual
- 1ea. HSL-WI5 Program Disk

The following items are optional items and can be purchased separately as required or desired:

- 1ea. RSV34-MS1 Resolver
- 1ea. RSV-RSCBLE-XX Resolver Cable

## 2.2 POWER REQUIRED

The HSL-WI5 is powered from 115/230VAC 50/60HZ and +24VDC. The 115/230VAC is used to power the P4500 power supply while the +24VDC is used to power the +24VDC I/O (sensors, clutch solenoids, etc.).

**Note:** +24VDC solenoids must be used for all clutch, cupfeed, and air strip solenoids. These provide a much more consistent and repeatable response time than 115VAC solenoids. Assuming +24VDC solenoids were used in the existing system, the +24VDC current required by the HSL-WI5 is no more than the existing systems +24VDC current requirement therefore the existing +24VDC power supply should be adequate.

## 2.3 MOUNTING AND WIRING THE HSL-WI5

The HSL-WI5 control panel should be mounted in the existing control cabinet. Perform the following steps to mount the HSL-WI5:

Refer to the "Recommended Cut-Out" in figure 1. Create a cut-out in the door of the existing control cabinet and mount the D4591 Keypad/Display and connect the ribbon cable from the M4500 to the display.

**Note:** The Keypad/Display must be located within 6 feet of the M4500 to avoid EMI pick-up on the display ribbon cable.

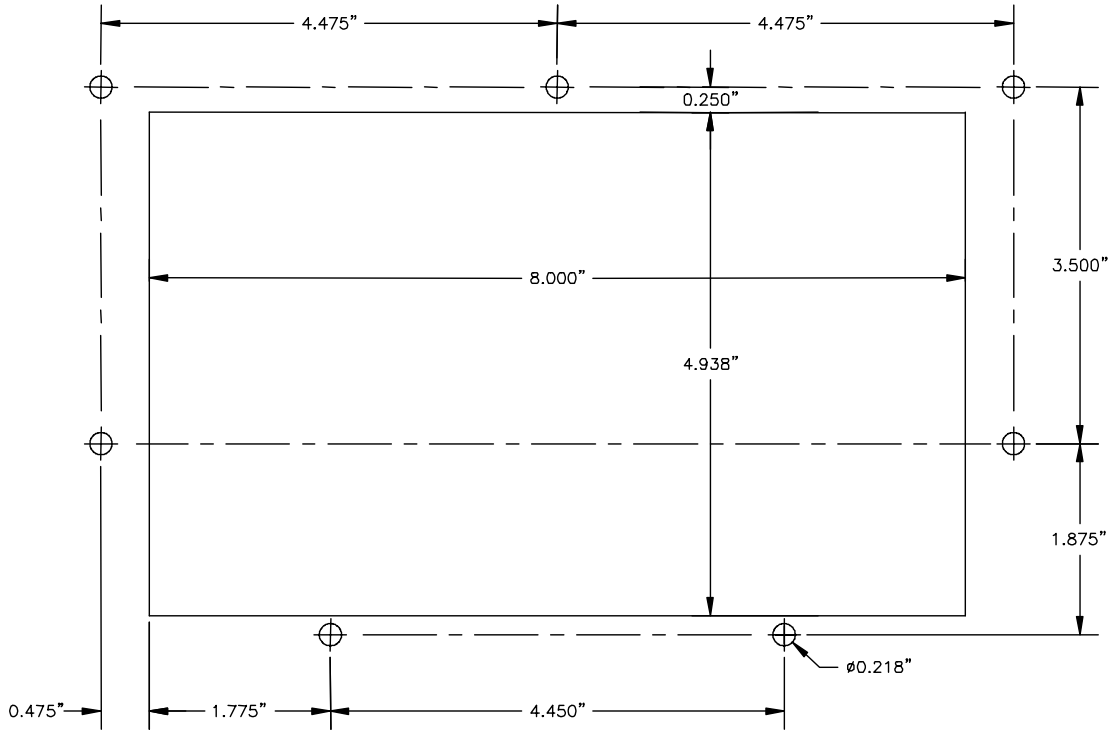



**Figure 1 –Recommended Panel Door Cut-out**

Referring to the electrical control schematic at the back of this manual, wire the HSL-WI5 as follows:

**Note:** Keep all +24VDC wiring, resolver cable, and trimmer speed reference wiring away from high voltage wiring. Wire the machine-mounted resolver directly to the 8-pin resolver input connector on the M4500.

1) Incoming Power: 115VAC-230VAC to FU1, neutral to 900 and ground to GND. Logic power (+24VDC) to 501 and common to 500. Control power (+24VDC) to 601 and common to 600.

2) Interlocks from existing control system to HSL-WI5 (terminals I14 through I23).

3) Interlocks to existing control system from HSL-WI5 (terminals O10, O15 through O24) and FLT output.

4) Wire the Clutch Solenoids to O10 and O11 (see note 2 of the electrical control schematics). Wire the Cupfeed and Air Strip solenoids to FU4 through FU6.

5) Short Can Sensor (I08) and Flywheel Motion Sensor (I10) using three conductor shielded cable. The shield of the sensor cable should be tied to earth ground at a terminal inside the existing control cabinet and left floating at the sensor.

6) Set-Up Enable key switch (if desired).

7) Resolver cable from resolver or existing PLS to RO-S4 connector on M4500 using a three pair, two-conductor shielded cable. The shield of the resolver cable should be tied to the “SHLD” terminal of the resolver input connector. Make sure the resolver cable shield is left floating at the resolver.

8) Trimmer Speed reference (0-10Vdc) analog output to trimmer drive (if used), using two conductor shielded cable. It may be necessary to use an analog isolation amplifier (not provided) to isolate the drive from the M4500 to prevent damage to the module.

## 2.4 MOUNTING THE RSV34-MS1 RESOLVER (IF REQUIRED)

The HSL-WI5 is designed to interface to a resolver (not encoder) for machine timing. If the machine is not already equipped with a resolver, then the existing encoder will have to be removed and an RSV34-MS1 resolver will have to be mounted in it's place. If this is the case, refer to the RSV34-MS1 data sheet for details on mounting the resolver. Use the RSV-RSCBLE cable to connect the resolver to the HSL-WI5. Route the resolver cable in a separate conduit, away from all other high voltage and control wiring. Wire the cable directly to the 8-pin resolver connector on the HSL-WI5 (see section 2.3).

## 2.5 HSL-WI5 SOFTWARE INSTALLATION

The HSL-WI5 set-up software is used to

- Download the Program to the M4500
- Tune (Set-Up) the User Adjustable Variables
- Download and Upload (Save) the User Set-Up Variables to Disk
- View Shift Data

Follow the steps below to install either the HSLWI5 setup program and PLC application program on a PC used to support the HSL-WI5 control system.

### 2.5.1 SETUP PROGRAM INSTALLATION

The HSMWI5 setup program is compatible with Windows 95/98/ME/2000/XP operating systems.

To install the set-up software, perform the following steps:

1) Insert the HSL-WI5 CD into the drive

2) From the Windows desktop, “Click” Start and then select run.

3) From the “Run” dialog box, “Click” the Browse button. Select the drive with HSL-WI5 CD. Select the “setup.exe” file and “Click” Open and then Ok.

4) This will initiate the installation process. Follow the instructions that appear on the screen to complete the installation process. The HSMWI5 setup program can be executed from the “Systems” folder located in Programs.

### 2.5.2 SYSDEV PROGRAM DEVELOPMENT SOFTWARE INSTALLATION

The SYSdev Program Development software is used to perform on-line trouble-shooting and program modifications to the HSL-WI5. If SYSdev was purchased with the HSL-WI5 package and is not already installed on the your computer, install SYSdev onto the hard drive of your computer following the steps in the SYSdev Program Development manual.

### 2.5.3 APPLICATION PROGRAM INSTALLATION

The application program is a SYSdev based program, loaded into the M4500 module and performs the HSL-WI5 logic. The program is written in a combination of Ladder logic and High-level. If the user desires to make program changes or perform on-line monitoring of the program execution the files, which constitute the HSLWI5 program, will have to be loaded onto the hard drive of the PC used to support the system. The SYSdev Program Development Software will also have to be loaded on the PC. To install this program perform the following:

1) Install the "PROGRAMS" disk into the drive.

2) Create one directory off the root directory of the PC for the files that makeup the HSLWI5 application program.

3) Copy all the files from the program disk to this subdirectory.

## 2.6 MODIFY EXISTING PLC PROGRAM

Modify the existing control system PLC program to interface with the HSL-WI5 by incorporating the following into the existing PLC ladder logic:

1) The HSL-WI5 now controls the clutch BDC stop, cupfeed, air strip, and short can detection. Defeat the existing short can detection in the PLC and add the following alarm inputs from the HSL-WI5:
   - "Short Can" (O18)
   - "Can Sensor/Timing Fail" (O19)
   - "Brake Response Too Long" (O20)

   **Note:** These alarms must immediately disable the clutch logic in the PLC. The alarms are true logic ("on" when alarm detected).

2) Add the following inputs into the PLC logic:
   - **Clutch ON (O10)**: This signal indicates the state of the clutch solenoids.
   - **Pulse Train 3-PPS (O16)**: This pulse train signal gives three pulses per stroke. It is intended as a check for ram motion once the clutch solenoids have been engaged.
   - **Logic Sync CH07 (O17)**: This signal is based on the state of timing channel CH07 (PLC Clock Timing). It provides the host PLC with one pulse per stroke and is generally set for 180 degrees on, 180 degrees off.
   - **Flywheel at Bar Speed (O21)**: This signal is set when there is no motion detected by the main crank resolver.
   - **Flywheel at Inch Speed (O22)**: This signal is set when the RPM of the resolver is above the bodymaker Low Speed threshold set-point.
   - **Flywheel at Punch Speed (O23)**: This signal is set when the RPM of the resolver is above the bodymaker High Speed threshold set-point.
   - **Cupfeed is Open (O24)**: This signal is provided to the host PLC to indicate that the cupfeed is open and the bodymaker is in production.

3) Add the "Clutch ON (IMED)" and "Clutch ON (BDC)" outputs into the PLC logic. In general, these can be derived from the logic that use to drive the clutch solenoids by removing the BDC timing signal from the original logic.

   Both outputs should come on simultaneously to engage the clutch. To perform an immediate or emergency stop, turn off the "Clutch ON (IMED)" signal. To perform a BDC stop, turn off the "Clutch ON (BDC)" signal. In either case removal of either signal will disengage the clutch.

4) Add the "Run (not Bar)" mode output to the existing PLC logic. This signal should be ON to run the machine in either continuous, single or inch modes and should otherwise be off.

5) Add the "Continuous", "Single", and "Inch" mode outputs to the existing PLC logic. The respective output should be ON when the corresponding mode is selected when in "Run" (not Bar) mode.

6) Add the “Cupfeed On” output into the PLC program. In continuous and single modes, this signal should be the summation of the cupfeed auto mode and all line control stand-by conditions (when “on”, the cupfeed will be timed opened by the HSL-WI5 when the machine is running and feed cups in the normal production mode). In inch mode, the cupfeed will be opened when this output is “on”.

7) Add the “Cupfeed Auto Enable” output to the PLC program. This must be ON to open the cupfeed in normal production.

8) Add the “Cupfeed ON Manual” output to the PLC program. With the machine stopped, activating the “Cupfeed ON Manual” input opens the cupfeed. When the “Cupfeed ON Manual” input is off, the cupfeed is closed. With the machine running, activating the manual cupfeed feeds one cup with the corresponding three strokes of air strip prior to making the cup.

9) Add the “Alarm Reset” output to the PLC program. This signal should be “on” as long as the system reset push-button is depressed.

10) Add the “End of Shift” output to the PLC program. This signal is used transfer the “Current Shift” data to the “Last Shift” data at the end of an eight or twelve hour period.

## 2.7 HSL-WI5 SET-UP

The HSL-WI5 is shipped from the factory with the PLC program "HSLWI5" loaded in the PLC section of the HSL-WI5 module and the PLS channel set-point file "WI5TMG" loaded in the PLS section. In most cases, the following user variables and timing channels may have to be altered to tune the HSL-WI5 to the actual bodymaker it is controlling.

Once the HSL-WI5 is installed and the control system is powered back up, perform the following to set-up and tune the HSL-WI5. The set-up is performed using the Display/Keypad or a PC running the "HSLWI5" set-up program. See section 3 for a description of the Keypad commands and menu displays of the HSL-WI5 Keypad/ Display. See section 4 for a description of the menus, variables and how to use set-up program.

### 2.7.1 DEFAULT SET-UP VARIABLES

As shipped, the set-up variables for the M4500 main processor are set to the following defaults:

Brake Wear Compensation:
- Enabled: Y
- Desired BDC Stop Position (cont./single): 000°

Maximum Allowed Stopping Response: 350°

Bodymaker Running Speeds:
- Low Speed (SPM): 175
- High Speed (SPM): 350

Number of Cupfeed Open/Initial Air Strip Strokes:
- Number of Strokes Before Cupfeed Open: 2
- Number of Cans Made with Initial Air Strip: 20

Trimmer Speed Reference:
- Maximum Speed: 375
- Idle Speed (W/I stopped): 250

The "WI5TMG" timing channel file, as shipped, contains the following default timing set points:

| CHAN | ON - OFF | DESCRIPTION |
|---|---|---|
| CH00: | 150 – 170 | BDC (Cont./Sing) timing |
| CH01: | 200 – 220 | BDC (Inch) timing |
| CH02: | 155 – 175 | Short Can Check timing |
| CH03: | 110 – 130 | Sensor Check timing |
| CH04: | 150 – 350 | Cupfeed timing |
| CH05: | 150 – 200 | Air strip (Normal) timing |
| CH06: | 120 – 190 | Air strip (Initial) timing |
| CH07: | 180 – 000 | PLC Clock Timing |

## 2.7.2 VERIFY MAIN CRANK RESOLVER

Using the Keypad/Display, press the "Set-up" key and select option 3 "Set Machine Timing" (see section 3.4.3). Verify that the main crank resolver direction is correct and linear by barring or inching the machine forward. The position (POS) should increment linearly through the range of 0 to 359. If the direction is backwards, reverse the S1 and S3 leads where the resolver cable connects to the M4500. If the position is not linear (increments up then down or does not increment through full range), verify that the resolver leads are all connected and connected correctly. Refer to the electrical control schematics at the back of the manual for wiring details.

### 2.7.3 SET BODYMAKER SET-UP PARAMETERS

The Bodymaker set-up parameters include:
1) Enabling or Disabling the Brake Wear Compensation
2) Setting the Desired Stopping Points (if the brake wear compensation is enabled)
3) Setting the Maximum Allowed Stopping Response
4) Setting the Bodymaker Running Low and High Speeds
5) Setting the Number of Strokes before the Cupfeed Opens and Number of Cans Made With Initial "Air Strip"

**Brake Wear Compensation:** If the brake wear compensation is to be used, enable it by setting the "Brake Wear Compensation Enable" to "Y" and set the "Desired BDC Stop Position (cont./single)". The desired BDC stop position is the desired location of the ram when it comes to rest after a BDC stop. The desired stopping position is generally set to 000 degrees. Enabling the brake wear compensation allows the M4500 to automatically adjust the BDC timing channel (CH00-Cont./Single) as necessary such that the press will stop at the desired stopping position regardless of the actual brake response.

If the brake wear compensation is not to be used, disable it by setting the "Brake Wear Compensation Enable" to "N". Disabling the brake wear compensation requires the BDC timing (CH00) signal to be set manually such that the press stops at BDC.

**Note:** If the brake response then changes, the press will not stop at the desired position if the brake wear compensation is disabled.

**Maximum Allowed Stopping Response:** This parameter defines the maximum allowed brake response before the "Brake Response Too Long" alarm is generated. If the actual brake response (number of degrees from when the brake is activated to the position where the press ends up at rest) when a BDC stop is performed is longer than this number, the alarm is generated. If the actual brake response is less, the alarm is not generated. Set this parameter to the value where the brake response is considered too long and service to the brake should be performed (typically 270 to 350 degrees).

**Bodymaker Running Speeds:** Set the Bodymaker running "Low Speed" and "High Speed" to the speeds that the bodymaker will actually run at when the respective speed is selected.

**Note:** This is not a speed reference that will make the bodymaker run at the speeds entered but is instead simply parameters used by the M4500 to know when to switch between the "High" and "Low" speed settings.

**Number of Strokes before Cupfeed Open:** This is the number of strokes (plus 2) that the machine will make with air strip once the cupfeed is enabled, before it actually opens. This allows coolant to be blown from the ram to prevent "Hydraulic Lock" (normally set to 2).

**Number of Cans made with Initial Air Strip:** This is the number of cans made using the CH06 – "Initial Air Strip" timing channel when the cupfeed is first opened before switching to CH05 – "Normal Air Strip". This allows the first cans to made with more "Air Strip" while the tooling is cool.

See section 3 "Using the Keypad/Display" or section 4 "HSLWI5 Set-up Program Reference" for details on setting the above set-up parameters.

### 2.7.4 SET TRIMMER SPEED REFERENCES

Set both the "Trimmer Maximum Speed" and "Trimmer Idle Speed" as desired. These two parameters are used to control the speed reference (0-10VDC) to the trimmer.

**Trimmer Maximum Speed:** The "Trimmer Maximum Speed" parameter is used to scale the 0-10VDC analog output such that when the bodymaker is running at the speed entered in "Trimmer Maximum Speed", the analog output will be at 10 volts.

**Trimmer Idle (Minimum) Speed:** This parameter determines the speed the trimmer will run at when the bodymaker is stopped (de-clutched).

**Note:** When the bodymaker is running, the trimmer speed reference is proportional (as set by the "Trimmer Maximum Speed" scaling) to the speed of the bodymaker. This parameter is used to provide the speed reference when the bodymaker speed is zero.

See section 3 "Using the Keypad/Display" or section 4 "HSLWI5 Set-up Program Reference" for details on setting the above set-up parameters.

### 2.7.5 SET MACHINE ZERO

Inch the main crank of the bodymaker to back dead center (BDC) and set the M4500 offset using the D4591 Keypad/Display.

1) Press the "Set-up" key and select option 4 "Zero Machine (set resolver offset)", see section 3.4.4.

2) Enter "0" to set the resolver offset. The timing set-up menu will then be displayed, showing the "POS:" at zero. The M4500 calculates the actual offset value required to make this the zero position and displays this number in the offset field.

3) Return to the primary set-up menu by pressing <ESC>. Return to the default screen by pressing <ESC> again.

### 2.7.6 VERIFY LOCATION OF SHORT CAN TIMING (CH02)

Inch the machine and verify that the “Short Can” timing (CH02) of the M4500 first turns ON when the short can sensor is over the nose of the punch on the forward portion of the stroke. This would be where the sensor would first “see” the can as it emerges from the die set. Verify that the “Short Can” timing turns “off” right before the sensor would quit seeing the lip of the can as the ram continues it's forward motion. Adjust either or both of the ON or off locations of CH02 until the above is achieved. Depending on the location of the short can sensor, CH02 is typically set ON at 155 degrees and off at 175 degrees.

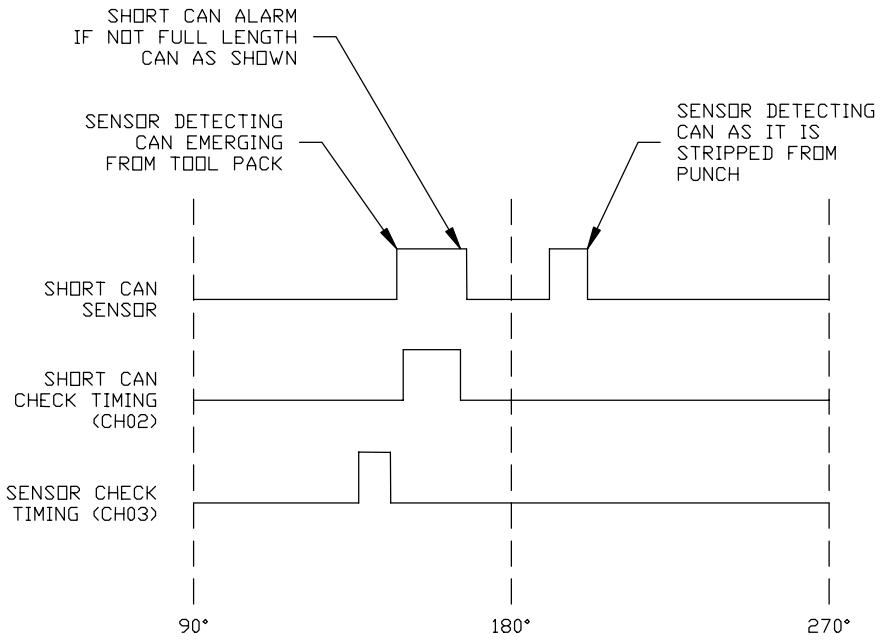



**Figure 2 – Short Can Check Timing Sequence**

**Note:** The short can sensor must "see" can the entire time the "Short Can" timing (CH02) is ON in order to pass the short can check, otherwise the "Short Can" alarm will be generated.

Verify that the "Sensor Check" timing (CH03) is set correctly. This timing signal should go ON for 20 degrees then off prior to the punch emerging from the die set (typically 110 to 130 degrees). This signal is used to verify that the short can sensor has not failed ON and therefore the short can sensor must be off the entire time CH03 is ON otherwise the "Die Sensor Fail" alarm is generated.

See section 3 "Using the Keypad/Display" or section 4 "HSLWI5 Set-up Program Reference" for details on setting CH02 and CH03.

### 2.7.7 VERIFY SINGLE CUPFEED

With the machine running in continuous mode and the "Cupfeed Auto Enable" off, feed a single cup through the machine by depressing the "Cupfeed ON Manual" push-button. The cupfeed solenoid should open for one cup and activate the air strip for three strokes prior to the can being punched (can punched on fourth stroke). Verify the cupfeed timing (CH04), air strip timing (CH05 and CH06), and short can timing (CH02). Adjust as necessary to achieve smooth cupfeed operation with no false short can shut downs.

### 2.7.8 VERIFY MACHINE OPERATION

Run the machine in normal production.

**Verify Air Strip Timing:** With the machine running and the cupfeed open, adjust the respective "Air Strip" timing (CH05-Normal, CH06-Initial) and verify that the cans are stripped without any problems. See section 3 "Using the Keypad/Display" or section 4 "HSLWI5 Set-up Program Reference" for details on adjusting CH05 and CH06.

**Verify Short Can Timing:** With the machine running and the cupfeed open, verify that no false short can faults are occurring (short can alarm occurs when full length can is made). If a false short can alarm are occurs, narrow the short can timing window one degree at a time until false short can alarms are no longer generated.

Verify that the short can detection is working correctly by generating a short can and verifying that the short can alarm is generated. This can be done by stopping the press, removing one of the die rings, then punching a cup in single stroke mode. The short can alarm should be generated when the cup is punched.

**Verify BDC Stop:** If the brake wear compensation is enabled, verify that the press does stop at the desired location.

**Note:** When the system is first installed, it will take a few successive stops for the algorithm to program the BDC timing channel to the correct position. The compensation is enabled after the press has been running at a fixed speed in continuous. The BDC timing channel will not be modified when single strokes are made or if press is started in continuous and then immediately stopped again. Wait about 5 seconds after the press is started before performing the BDC stop to verify the stop position.

If the brake wear compensation is disabled, manually adjust both the BDC (Cont./Single) timing (CH00) and the BDC (Inch) timing (CH01) such that the press stops at back dead center at both respective speeds. See section 3 "Using the Keypad/Display" or section 4 "HSLWI5 Set-up Program Reference" for details on adjusting CH00 and CH01.

**Verify BDC Stop Sequence:** Perform a normal manual BDC stop while the cupfeed is open and verify that the cupfeed closes. The machine should make two extra strokes processing the two remaining cups in the cupfeed cam and stop at BDC with no cups in the cup locator or cupfeed cam. This sequence should be true for standby stops and BDC alarm stops as well.

**The Machine is Now Set-Up and Ready to Run!**

## 2.8 M4500/P4500/D4591 INSTALLATION

The following is provided as a reference only. These steps are performed by the factory prior to shipping the HSL-WI5. These steps need only be performed in the event either the M4500 module, P4500 power supply, or D4591 display need to be replaced. Refer to the M4500 User's Manual for general details on installing the M4500, P4500, and D4591.

### 2.8.1 M4500 MODULE INSTALLATION

To install the M4500 module, perform the following:

1) Remove the cover from the M4500 chassis (retained with three captive screws on the lower front of the cover and two captive screws on each side of the M4500 chassis).

2) Install the S4563 (SLOT0-0, furthest left slot): Set the slot address dip switches (SW1) to the following positions:

   S4563: SW1 switch1 = "OFF"
   SW1 switch2 = "OFF"

3) Install the S4573 (SLOT0-1, slot next to S4563): Set the slot address dip switches (SW1) to the following positions:

   S4573: SW1 switch1 = "ON"
   SW1 switch2 = "OFF"

4) Install the on the M4500, making sure all the board connectors protrude through the slots in the cover. Tighten the three captive screws on the lower front of the cover and the two captive screws on each side of the M4500 chassis.

5) Connect the display ribbon cable to the connector on the back of the M4500 (the connector will mate with the connector on the M4500 only one way).

6) Mount the M4500 chassis to the HSL-WI5 back panel using four 8-32 screws.

7) With power to the P4500 "off", install the P4500 power supply cable to the +5/C/+12/C/-12 connector on the M4500 (the connector will mate with the connector on the M4500 only one way).

8) Install the respective field wiring arms on all the I/O boards of the M4500 (I/O slots 0 and 1, resolver connector, and IN0/IN1 connector). Make sure all field-wiring connectors are fully mated to the M4500.

### 2.8.2 P4500 POWER SUPPLY INSTALLATION

To install the P4500, perform the following steps:

1) Mount the P4500 to the HSL-WI5 in the mounting holes next to the M4500 (left side) using two 8-32 screws.

2) With power to the P4500 "off", install the P4500 power supply cable to the +5/C/+12/C/-12 connector on the M4500 (the connector will mate with the connector on the M4500 only one way).

### 2.8.3 D4591 KEYPAD/DISPLAY INSTALLATION

To install the D4591, perform the following steps:

1) With the gasket installed on the mounting studs of the D4591, install the D4591 in the cut-out of existing control cabinet. Secure the display to the enclosure using 7ea. 8-32 nuts and external lock washers.

2) Connect the display ribbon cable to the connector on the lower back of the display.

### 2.8.4 DOWNLOAD HSLWI5 APPLICATION PROGAM AND SET-UP DATA TO M4500

Once the M4500/P4500/D4591 are installed, perform the following to download the application program as well as the previously saved set-up data and timing channel set-points:

1) Power up the M4500 and the PC used to interface with the HSL-WI5.

2) Connect an RS-232 cable from the computer COM port on the computer to the "PROG" port on the M4500.

3) Execute the HSLWI5 setup program.

4) Download the HSLWI5 application program to the M4500, see section 4.2.3.

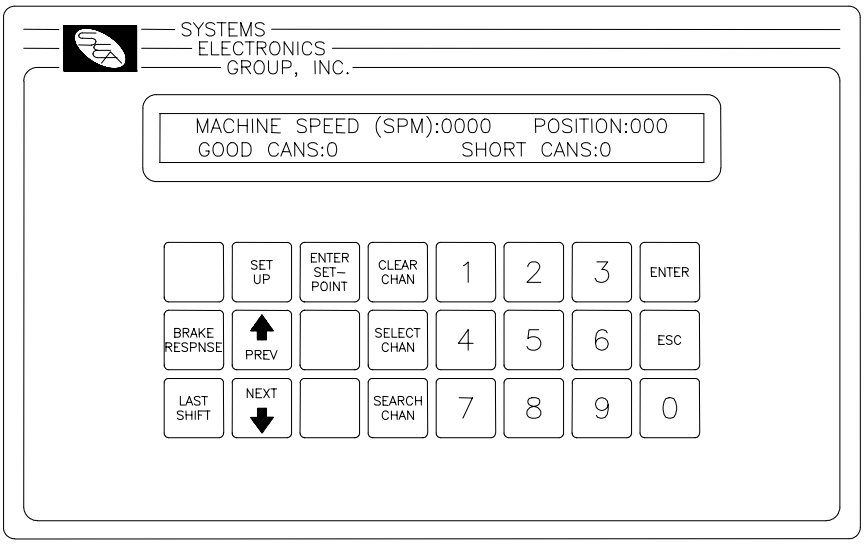
5) Download the previously saved set-up data to the M4500, see section 4.2.4.

6) The M4500 is now ready to run, loaded with HSLWI5 application program, timing set-points, and set-up data.

   **Note:** Double check the machine zero position and re-zero the resolver if necessary, prior to running the machine.

# SECTION 3
# USING THE KEYPAD/DISPLAY

The keypad of the D4591 contains 24 keys consisting of data display commands, set-up commands, and a numeric keypad. The display of the D4591 is a 2 line by 40-character backlit LCD display that displays the selected data and set-up menus. The Keypad/Display can be used to view data or adjust the timing and set-up parameters.




The Keypad/Display allows the following to be viewed or adjusted:

1) Set the Bodymaker Parameters
2) Set the Trimmer Parameters
3) Set Machine Timing
4) Set Machine Zero
5) View the Actual Brake Response (in degrees)
6) View the Current Shift Data
7) View the Last Shift Data
8) View Life Time Stroke Count

The definitions of the keypad commands and menus are described in the following sections.

**Note:** For virtually all the menus, the "NEXT" and "PREV" keys can be used to advance to the next item of the menu or retard to the previous item. To change a parameter, simply enter the new value on the numeric keypad and press <ENTER>. The value will be entered and the next parameter will automatically be displayed. When the last parameter is entered, the primary set-up menu is again displayed. Pressing <ESC> at anytime will also exit you back to the primary set-up menu.

# SECTION 3
# USING THE KEYPAD/DISPLAY

## 3.1 DEFAULT SCREEN

The default screen (displayed when no other commands are active) contains the following data:

MACHINE SPEED (SPM):xxxx  POSITION:xxx
GOOD CANS:xxxxxxx  SHORT CANS:xxxxxx

The "Machine Speed" is the current speed of the bodymaker, the "Position" is the current angular position of the bodymaker crankshaft, the "Good Cans" field is the total number of good cans produced so far into the current shift and the "Short Cans" field is the total number of short can faults for the current shift. This display effectively replaces a speed meter, a position display and two can counters. This screen is always returned to when no other commands are active.

## 3.2 "BRAKE RESPONSE" KEY

This key displays the brake response when a "BDC" stop is performed. The response is the number of degrees it takes the press to stop from when the clutch is de-activated for a BDC stop to the position that the machine comes to rest. This can be used to determine the general condition of the brake and whether servicing of the brake is required. To exit back to the default screen, simply press the "ESC" key.

## 3.3 "LAST SHIFT" KEY

The Last shift data menu displays the "Total Good Can" count and the "Total Short Can" fault count. This data is the totals for the last (previous) shift. This data is transferred from the current shift to the "Last shift" data when the end of shift input transfers from a "0" to a "1". This can be at the end of either an 8 or 12-hour shift.

**Note:** The Current shift "Good Cans" and "Short Cans" is displayed as part of the default screen (see section 4.5.1 – Main Display Window).

The Last shift data is defined as follows:

**Good Cans:** This is the total number of good cans produced for the previous shift. This is essentially a can counter.

**Short Cans:** This is the total number of short can faults the machine had the previous shift.

## 3.4 "SET-UP" KEY

This selection is used to invoke the primary set-up menu. This consists of the following six selections:

1: SET BODYMAKER PARAMETERS
2: SET TRIMMER PARAMETERS
3: SET MACHINE TIMING (SET POINTS, ETC.)
4: ZERO MACHINE (SET RESOLVER OFFSET)
5: DISPLAY LIFETIME STROKE COUNT

When selected, each of the above selections brings up a sub-menu with the corresponding set-up parameters. The following sections describe these sub-menus and the definitions of the corresponding variables. To select the respective set-up sub-menu, simply press the corresponding numeric key (1 through 5).

**Note:** The primary set-up menu is protected with an enable switch inside the logic compartment of the main control panel. The "M4500 Set-up Enable" switch must be in the "Enable" position in gain access to the primary set-up menu.

### 3.4.1 SET BODYMAKER PARAMETERS

This menu is activated when the "1" key (SET BODYMAKER PARAMETERS) is pressed while the primary set-up menu is active. The following four set-up parameters may then be adjusted or viewed:
**Brake Wear Comp Enable? (0=No, 1=Yes):** This prompt is used to enable or disable the brake wear compensation. If the compensation is to be disabled, enter "0". If the compensation is to be enabled, enter "1".

**Desired BDC Stop POS (Cont./Single):** This is the desired stopping location (in degrees) for a BDC stop when brake wear compensation is enabled. This is typical set to 000 degrees (Back Dead Center). This prompt is only displayed when the brake wear compensation is enabled.

**Maximum Allowed Stopping Response:** This defines the maximum allowed brake response before a "Brake Response Too Long" alarm is generated. If the actual brake response (number of degrees from when the brake is activated to the position where the press ends up at rest) when a BDC stop is performed is longer than this number, the alarm is generated. Set this parameter to the value where the brake response is considered too long and service to the brake should be performed (typically 270 to 300 degrees).

**Running Bodymaker Low Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run in low (inch) speed.

**Running Bodymaker High Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run when in high (cont./single) speed.

**Number of Strokes before Cupfeed Open:** This is the number of strokes (plus 2) the machine will make with air strip once the cupfeed is enabled, before it actually opens. This allows coolant to be blown from the ram to prevent "Hydraulic Lock" (normally set to 2).

**Number of Cans made with Initial Air Strip:** This is the number of cans made using the CH06 – "Initial Air Strip" timing channel when the cupfeed is first opened before switching to CH05 – "Normal Air Strip". This allows the first cans to made with more "Air Strip" while the tooling is cool.

### 3.4.2 SET TRIMMER PARAMETERS

This menu is activated when the "2" key (SET TRIMMER PARAMETERS) is pressed while the primary set-up menu is active. The following trimmer set-up parameters may then be adjusted or viewed:

**Trimmer Maximum Speed (CPM):** The "Trimmer Maximum Speed" parameter is used to scale the 0-10VDC analog output such that when the bodymaker is running at the speed entered the analog output will be at 10 volts. This is typically set to the running high speed of the Bodymaker or slightly higher.

**Trimmer Minimum Speed (CPM):** This parameter determines the speed the trimmer will run at when the bodymaker is stopped (de-clutched).

**Note:** When the bodymaker is running, the trimmer speed reference is proportional (as set by the "Trimmer Maximum Speed" scaling) to the speed of the bodymaker. This parameter is used to provide the speed reference when the bodymaker speed is zero.

### 3.4.3 SET MACHINE TIMING (SET-POINTS, ETC.)

This selection brings up the timing set-point menu, which displays the following fields:

```
CHuu  SETPOINT:xxx   []  "channel name"
RPM:yyyy    POS:zzz     OFFSET:wwww  SCALE:360
```

Each field is defined as follows:

| Field | Definition |
|---|---|
| CHuu | Currently selected channel (CH00 through CH17) where "uu" is the octal channel number. |
| SETPOINT:xxx | Channel "on" or "off" set-point where "xxx" is the set-point position |
| [] | State of channel set-point (blank = "off", solid block character = "on") |
| "channel name" | selected channel name: (CH00) BDC (CONT./SINGLE) TIMING, (CH01) BDC (INCH) TIMING, etc. |
| RPM:yyyy | Current machine speed where "yyyy" is in CPM. |
| POS:zzz | Current resolver position where "zzz" is in degrees. |
| OFFSET:wwww | Resolver offset where "wwww" is the offset in degrees. |
| SCALE:360 | Resolver SCALE FACTOR (360 degrees per revolution). |

In addition to displaying the timing set-point menu, the following keys are also enabled: "ENTER SET-POINT", "CLEAR CHANNEL", "SELECT CHANNEL", and "SEARCH CHANNEL".

The "ENTER SET-POINT" key is used to enter a new set-point (both "on" and "off" set-points) in the selected channel. The "CLEAR CHANNEL" key is used to clear all set-points from the selected channel. The "SELECT CHANNEL" key is used to select a new channel for programming. The "SEARCH CHANNEL" is used to view both the "on" and "off" set-points in the selected channel.

**Searching Channel:** To view the set-points in a channel simply press the "SEARCH CHANNEL" key. The next "off" or "on" set-point is shown in the "SETPOINT" field. The state character [] will be a solid block if the set-point is ON or blank if the set-point is off.

**Entering or Adjusting Set-point:** To set-or adjust a timing channel, perform the following:

1) Select the channel to be adjusted by pressing the "SELECT CHANNEL" key, entering the channel number (00 to 07) and pressing enter. In addition, the "NEXT" and "PREV" keys can be used to advance to the next channel or retard to the previous channel.

2) Press "CLEAR CHANNEL" to clear out the current channel.

   **Note:** Entering a new set-point does not automatically clear the old set-point out. If the two set-points are not in the same place, the channel will simply have two set-points in it if the old one is not cleared out first. Therefore, always clear the channel before entering a new set-point. A set-point may however, be "extended" by programming another set-point onto an existing set-point using either the existing "on" or "off" set-point as the starting position for the new set-point. This will result in one larger set-point.

3) Press "ENTER SET-POINT" to enter the new set-point. The display will then prompt "ON SETPOINT:". Enter the position (in degrees) where the set-point should go "on" and press <ENTER>. The display will now prompt "OFF SETPOINT:". Enter the position (in degrees) where the set-point should go "off" and press <ENTER>. The channel will now be programmed with a set-point that goes "on" at the "on" position entered and "off" at the "off" position entered.

4) Return to the primary set-up menu by pressing <ESC>. Return to the default screen by pressing <ESC> again.

### 3.4.4 ZERO MACHINE (SET RESOLVER OFFSET)

To set the machine zero (resolver offset) perform the following:

1) Select "3: SET MACHINE TIMING" and observe the "POS:" field. Verify that as the machine is rotated forward (either inched or barred) that the position increases linearly from 0 through 359. If not, swap the S1 and S3 leads of the resolver cable at the M4500 resolver connector. Then verify that the position then indeed does increase with forward movement. Press "ESC" to exit back to the primary set-up menu.

2) Position the machine at machine zero (back dead center).

3) Auto zero the resolver by selecting "4: ZERO MACHINE" from the primary set-up menu. Enter "0" to zero the resolver. The timing set-up menu will be displayed, now showing the "POS:" at zero. The M4500 will calculate the offset value required to make this the 000 position and displays this number in the offset field.

4) Return to the primary set-up menu by pressing <ESC>. Return to the default screen by pressing <ESC> again.

### 3.4.5 DISPLAY LIFETIME STROKE COUNT

The lifetime stroke count is used to display the total number of strokes made by the machine. This register is never reset and displays the count in 1,000 can increments

Perform the following to view the lifetime stroke count:

1) Select "5: DISPLAY LIFETIME STROKE COUNT " from the primary set-up menu.

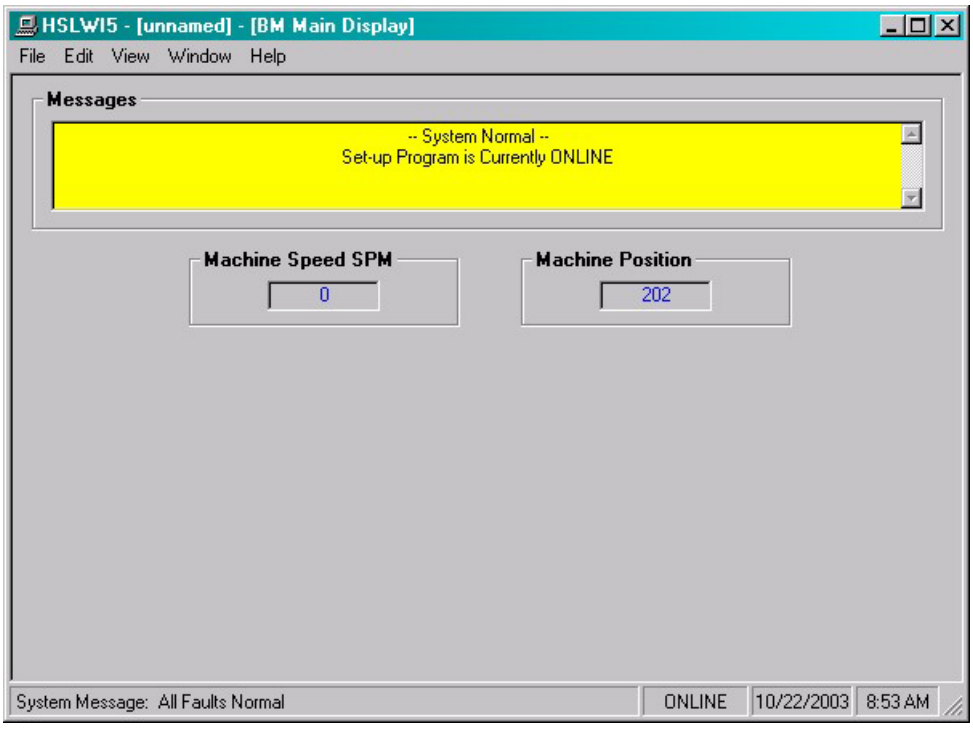
2) The M4500 will automatically display the total lifetime stroke count in thousands of cans.

3) Return to the primary set-up menu by pressing <ESC>. Return to the default screen by pressing <ESC> again.

# SECTION 4
# HSLWI5 SETUP PROGRAM REFERENCE

The set-up program is a Windows based menu driven program, allowing the user to easily view data, alter set-up variables or set machine timing (machine offset, timing signal locations, etc.), using a PC running the Windows™ (95/98/ME/2000/XP) operating system. The set-up variables are used to configure and tune the M4500 to match the configuration and performance of the specific bodymaker (see section 2.7 – HSLW-WI5 Set-Up).

**Note:** The set-up program is an on-line communications program used to interface with the. The data displayed and set in the windows is communicated directly to the module, while in the "Online" edit mode. Therefore, prior to going online with the processor, make sure an RS-232 cable is connected from the COM port on the computer to the "PROG" of the M4500. The variables displayed while in the "Online" edit mode are read directly from the processor. Data is saved to a "Set-up Data" file (*.sdt) whenever changes are made to a parameter or when data is uploaded from the processor.



# SECTION 4
# HSLWI5 SETUP PROGRAM REFERENCE

## 4.1 GENERAL DESCRIPTION

**Title Bar:** At the top of the window is the "Title Bar". The title bar is used to display the name of the working "Set-up Data" file, as well as, the name of the active "Window". The title bar is dark if the window is active and grayed if another window is active. The color depends on the settings of the Display Properties of the Control Panel.

**Status Bar:** At the bottom of the window is the "Status Bar". The status bar is used to display system messages, online or offline mode, as well as, the current time and date as set by the operating system. The system messages panel displays general information about operation of the system. The Online/Offline mode panel displays the status of the current set-up program mode of operation. The mode of operation can be changed by simply double clicking the online/offline mode panel.

**Hot Keys:** Hot keys are activated by holding down the "ALT" key and simultaneously pressing the underlined letter of the desired function. Almost every function can be activated by either pressing a series of hot keys or using the "TAB" key to move between fields.

**Online/Offline Modes:** The set-up program allows the user to make changes while "Online" with the processor. The "Offline" mode is used to preset parameters prior to download. All functions are available to the user while "Online", however, specific "Online" functions are disabled in the "Offline" edit mode.

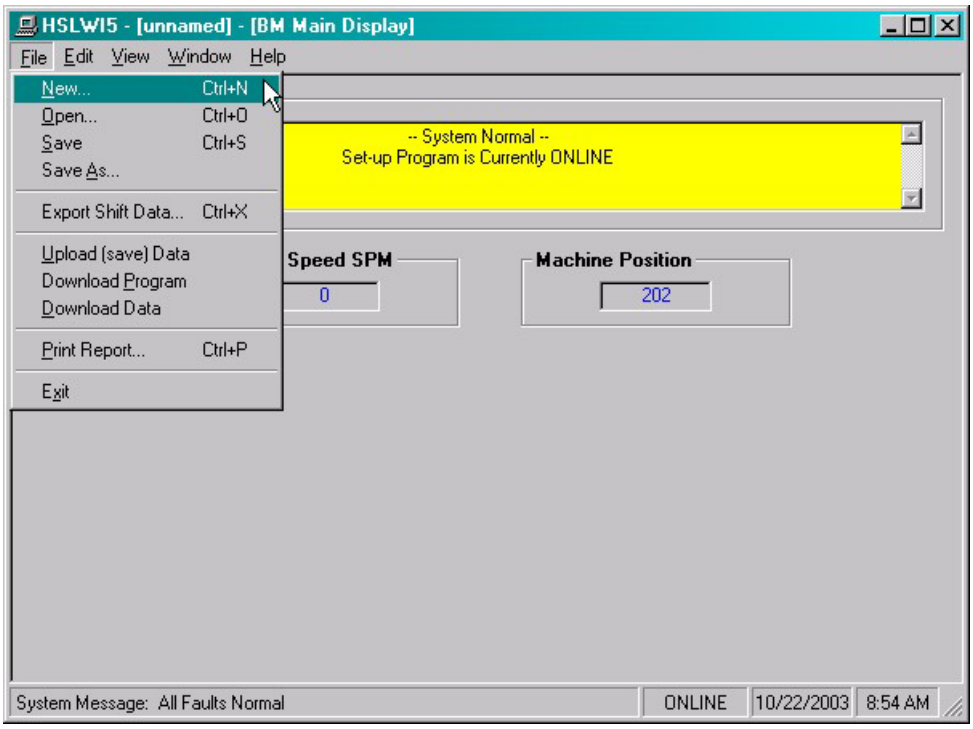
**Note:** Offline changes can only be made by enabling "Offline Editing", accessed from the "Edit" menu.

**Getting Help:** The entire contents of the user's manual is contained within the help file. Pressing Ctrl+H will display the help file window. Pressing the F1 key will display the contents file. Hot spots allow jumps to other topics to display additional information as desired. Selecting "About HSLWI5" from the Help menu will display a dialog box listing information about the current revision of the setup program and how to obtain technical support.

## 4.2 THE FILE MENU

The “File” menu allows the user to perform the following functions:

- Create a “New” set-up “Data File”.
- Open an existing “Data File”.
- Save any changes made to the current “Data File” to disk.
- Upload (save) Data from the M4500.
- Download a SYSdev (.sdv) program to the M4500.
- Download (restore) Data to the M4500.
- Print a Report of the current set-up parameters.
- Exit the set-up program



### 4.2.1 THE SETUP DATA FILE

The set-up "Data File" (.sdt) is a binary access file, designed for fast file I/O operation. When the set-up program is first invoked, the default set-up parameters are loaded into memory. If changes are made to any of the set-up parameters (either online or offline), as well as shift data, the user will be flagged to "Save Changes" upon exit of the program.

**Note:** Any windows based "Set-up" program can open a set-up "Data File", however, the data tables will not be properly aligned. If a set-up data file was created by either a different set-up program or a different revision of software, the user will be alerted to the problem.

The set-up "Data File" is similar to that of a word processing file. When the program first starts a default set of values is loaded and the user is able to make any changes as desired. The set-up program is unaware of the parameters that exist within the M4500. Therefore, to normalize the set-up program with the processor, the user should define or open an existing file, then upload (save) data from the processor. This allows the user to either create a backup of the data or maintain an existing file. The user can even open a data file for another machine, save the file to a new name, make the necessary changes and simply download the new parameters to another processor.

The following functions can be accessed any time, from any set-up or display windows.

**New:** To create a "New" data file, select "New" from the "File" menu or press "Ctrl + N". This creates a completely new file, loaded with the default variables and the word "[unnamed]" is displayed in the title bar. If any changes were made to the existing file, the user is prompted to save changes prior to exit.

**Open:** To "Open" and existing data file, select "Open" from the "File" menu or press "Ctrl + O". This displays a dialog box, which allows the user to navigate and select an existing data file to open and the name of the file will be displayed in the title bar. If any changes were made to the existing file, the user will be prompted to save any changes first.

**Save:** To "Save" data file to disk, select "Save" from the "File" menu or press "Ctrl + S". This displays a dialog box, which allows the user to select a folder and enter in a name for the file. The user will be notified if the file name already exists and the extension ".sdt" will automatically be added to the file name. If this is a "New" file, the user will be prompted to enter a file name.

**Save As:** To save the data file to a new name, select "Save As" from the "File" menu.. This displays a dialog box, which allows the user to select a folder and enter in a new name for the file. The user will be notified if the file name already exists and the extension ".sdt" will automatically be added to the file name.

**Export Shift Data…:** This function allows the user to export the shift data to a "Tab Delimited" text file. This allows the user to easily use the shift data to produce production reports.

### 4.2.2 UPLOAD (SAVE) DATA

The “Set-up” program allows the user to upload set-up parameters, timing channel set-points and shift data from the M4500 to a set-up “Data File”. This function is accessed from the “File”.

### 4.2.3 DOWNLOAD PROGRAM

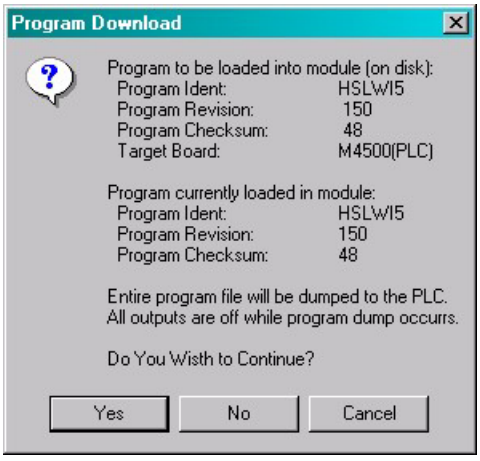
The “Set-up” program allows the user to “Download” any SYSdev program file to the M4500.

**Note:** To “Download” a SYSdev program to the processor, the program must be “Online”. If “Online” mode cannot be achieved, program download will not be executed. If the program is currently “Offline”, the user will be prompted to first go “Online”.

Once selected, and the set-up program “Online” with the processor, a dialog box will be displayed, allowing the user to select the SYSdev file to download.

**Note:** Only the files with the “.sdv” file extension will be displayed. It is important to keep in mind that only a valid M4500 PLC SYSdev file can be downloaded. Care should be taken when selecting the program to download.

Once selected, a message box is displayed informing the user of the current program, revision and checksum of the program loaded in the processor, as well as, that of the selected program.



The user must confirm their selection by clicking the "Yes" command button. After the user confirms their choice, program download is initiated and the current program download address is displayed. When program download is complete, the user is prompted to acknowledge. Control is passed back to the main program and the set-up program remains in an "Online" edit mode.

### 4.2.4 DOWNLOAD (RESTORE) DATA

The set-up program allows the user to download "Set-up" parameters, timing channel set-points and shift data to the M4500 from the set-up "Data File". This function is accessed from the "File" menu.

**Note:** Only the values contained within the current data file are used. If the validity of the current data file is questionable, review the data in an "Offline" mode prior to download.

### 4.2.5 PRINT REPORT

The "Set-up" program allows the user to generate a "Report" printout of all the set-up parameters, timing channel set-points and shift data (of the current set-up file). This function is accessed from the "File" menu. At the top of each page, the report displays the name of the set-up file, at the bottom of each page is the date and time the printout was generated, as well as the page number.

To printout a report of the settings contained in the set-up "Data File", perform the following:

1) From the "File" menu, select "Print Report" or press "Ctrl + P".

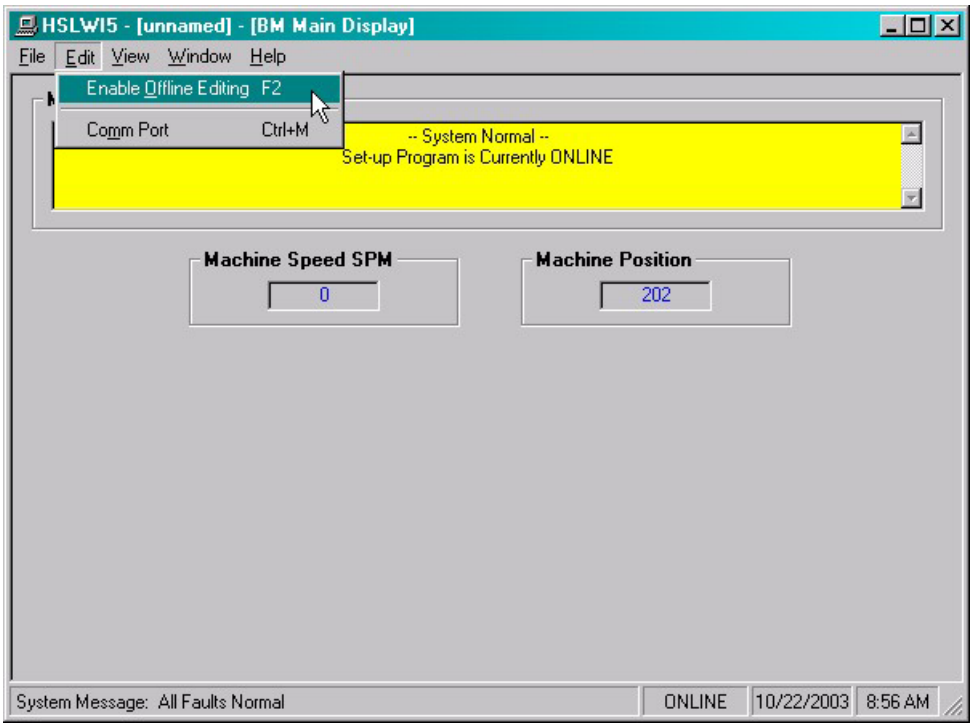
2) The "Print Setup" dialog box will then be displayed, allowing the user to select a printer, as well as, the paper size and orientation. Once the user selects "OK", the report is generated and sent to the specified printer device.

**Note:** This function makes use of the windows print manager, which allows the user to continue with their work while the document is being printed.

## 4.3 THE EDIT MENU

The "Edit" menu allows the user to perform the following functions:

- Enable/Disable Offline Editing.
- Set-up the Comm Port.



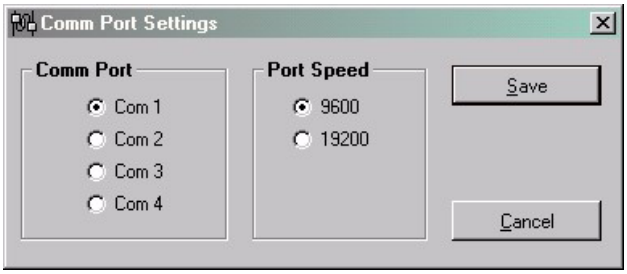

### 4.3.1 ENABLE OFFLINE EDITING

This function allows the user to perform "Offline" editing on the currently loaded set-up data file, making any necessary changes to set-up parameters or timing channels while not online with the processor.

If offline editing is not enabled, the user is only able to view the set-up and shift data. When the program is first invoked, the default setting is "Offline Editing" - disabled. The user will need to select "Enable Offline Editing" from the edit menu (or press function key F2) to enable or disable this feature.

### 4.3.2 SETUP COMM PORT

This function allows the user to specify the serial communications port and rate to talk to the M4500. The programming port of the M4500 is set to 9600 baud.



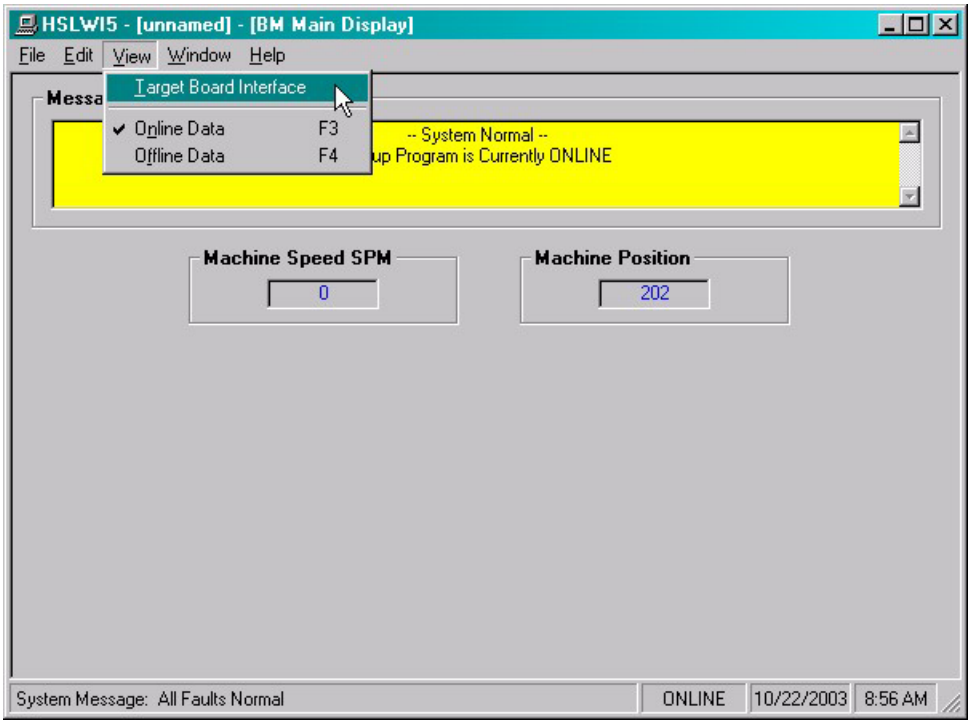

Once selected, a dialog box requesting the user to select a "Comm Port" and "Baud Rate" will be displayed. The default setting is COM1 at 9600 baud.

In most cases the user will only need to specify the communications port and leave the baud rate at 9600. If communication problems occur, make sure there is a secure connection from the PC to the PLC. Then check the Comm port. In most cases the user will only need to select a new Comm port. If communication problems persist, there may be another program causing a conflict with the port. Check the port configuration from the "Settings" folder.

## 4.4 THE VIEW MENU

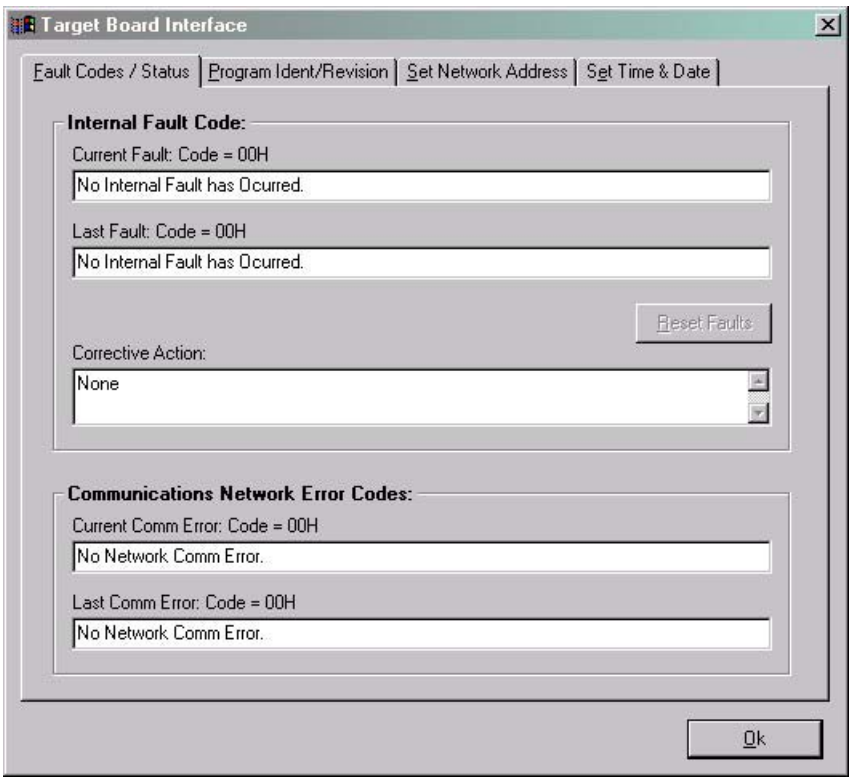
The “View” menu allows the user to perform the following functions:

- View the “Target Board Interface”
- View “Online” Data
- View “Offline” Data



### 4.4.1 TARGET BOARD INTERFACE

This function allows the user to view fault codes, S3000 network communication error codes and review the current "Ident" and "Revision" of the application program. This is accessed by the "View" menu, by selecting "Target Board Interface".




Once invoked, the set-up program will prompt the user to select a program to compare with the one existing in the processor. Whether a program is selected or the user cancels, the setup program will attempt to communicate with the M4500. If unsuccessful, a warning message will be displayed, prompting the user to either "Retry" or "Cancel" the operation. If the operation is canceled and communication with the processor cannot be established the system will be placed in an "Offline" mode, however the "Target Board Interface" window will be displayed.

### 4.4.2 VIEW ONLINE DATA

This function allows the user to place the set-up program in an "Online" mode with the processor. This is accessed by the "View" menu, by selecting "Online Data" or by simply pressing the "F3" function key.

**Note:** The program can be toggled between "Offline" and "Online" by simply double clicking on the "Online" or "Offline" panel displayed in the status bar at the bottom of the window.

Once invoked, the set-up program will attempt to open the Comm port and communicate with the M4500. If the set-up program is unsuccessful, a warning message will be displayed prompting the user to either "Retry" or "Cancel" the operation. If the operation is canceled and communication with the processor cannot be established the system will be placed in an "Offline" edit mode.

**Note:** Anytime while the set-up program is "Online" with the processor and communication is interrupted, a warning message will be displayed, prompting the user to either "Retry" or "Cancel" the operation.

### 4.4.3 VIEW OFFLINE DATA

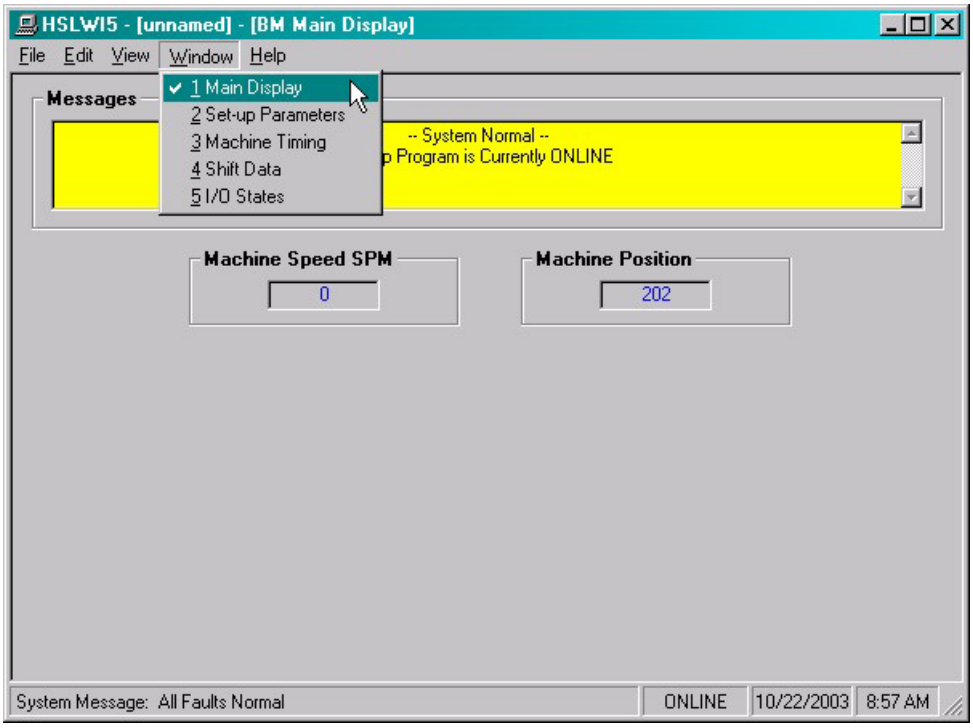
This function allows the user to place the set-up program in an "Offline" mode. This is accessed by the "View" menu, by selecting "Offline Data" or by simply pressing the "F4" function key. This allows the user to perform "Offline" editing. All values displayed in "Offline" edit mode reflect the actual values contained in the currently loaded set-up data file.

**Note:** The program can be toggled between "Online" and "Offline" by simply double clicking on the "Online" or "Offline" panel displayed in the status bar at the bottom of the window.

Once invoked, the set-up program will close the Comm port and cease communication with the M4500.

## 4.5 THE WINDOW MENU

The "Window" menu allows the user to select one of five different Display/Set-up windows to modify set-up parameters, view shift data or receive feedback about the current status of the control system.

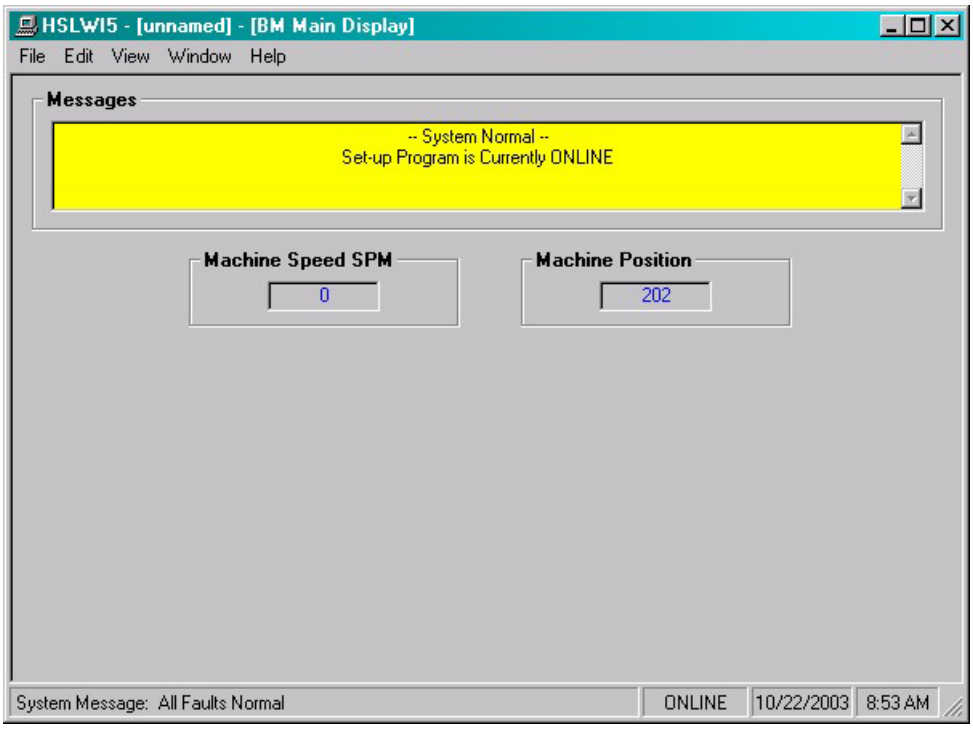



Once a window menu item is selected, a check mark is placed next to the selected item and the selected window is displayed with the name changed in the title bar of the main window.

**Note:** "Read" only variables are displayed in blue with a gray background. Any variables that can be altered by the user are displayed in black with a white background. In most cases, a parameter that can be changed by the user will have associated with it increment and decrement controls. The user can either click on the desired parameter to adjust and enter in a new value, or use the increment or decrement controls to change the value by 1 unit.

### 4.5.1 THE MAIN DISPLAY WINDOW

The "Main Display" window is used to display the general state of the control system. This window is selected from the "Window" menu.




The following is a list of the functions of the "Main Display" window.

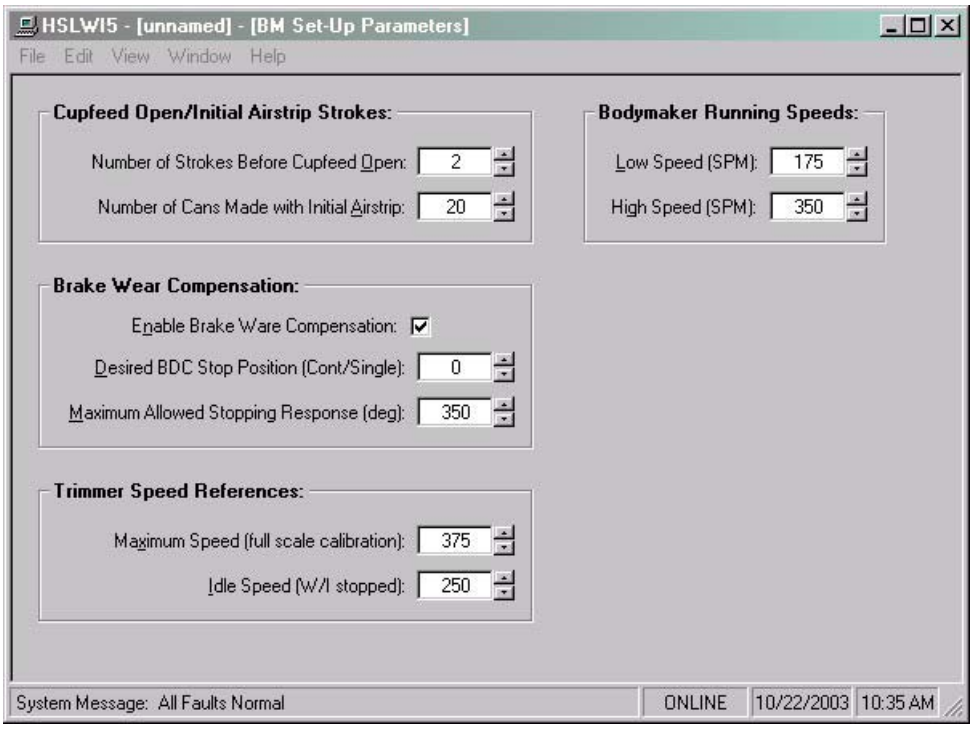
**Messages:** The "Messages" display is continuously updated. It displays alarm and status messages specific to the M4500, as well as, the current "Online" or "Offline" status of the set-up program. By simply scrolling the display, the user is able to view all active alarm and status messages. If no alarm or status messages are active, a default message is displayed.

**Machine Speed SPM:** This display is only active while "Online" and displays the current speed of the machine in "Strokes Per Minute".

**Machine Position:** This display is only active while "Online" and displays the current position to the main crank resolver in degrees..

## 4.5.2 THE SETUP PARAMETERS WINDOW

The "Set-up Parameters" window is used to view and adjust the set-up parameters. This window is selected from the "Window" menu.




### Canfeed Open/Initial Airstrip Strokes:

**Number of Strokes before Cupfeed Open:** This is the number of strokes (plus 2) that the machine will make with air strip, once the cupfeed is enabled, before it actually opens. This allows coolant to be blown from the ram to prevent "Hydraulic Lock" (normally set to 2).

**Number of Cans Made with Initial Air Strip:** This is the number of cans made using the CH06 – "Initial Air Strip" timing channel when the cupfeed is first opened before switching to CH05 – "Normal Air Strip". This allows the first cans to made with more "Air Strip" while the tooling is cool.

## Brake Wear Compensation:

**Brake Wear Compensation Enable:** This is used to enable or disable the brake wear compensation. If the compensation is to be disabled, click the checkbox to remove checked state. If the compensation is to be enabled, click the checkbox to set the checked state.

**Desired BDC Stop Position (Cont./Single):** This is the desired stopping location (in degrees) for a BDC stop when the brake wear compensation is enabled. This is typical set to 000 degrees (Back Dead Center).

**Note:** This parameter is automatically disabled whenever "Brake Wear Compensation" is disabled.

**Maximum Allowed Stopping Response:** This defines what the maximum allowed brake response is before the "Brake Response Too Long" alarm is generated. If the actual brake response (number of degrees from when the brake is activated to the position where the press ends up at rest) when a BDC stop is performed is longer than this number, the alarm is generated. If the actual brake response is less, the alarm is not generated. Set this parameter to the value where the brake response is considered too long and service to the brake should be performed (typically 270 to 300 degrees).

## Trimmer Speed References:

**Trimmer Maximum Speed (CPM):** The "Trimmer Maximum Speed" parameter is used to scale the 0-10VDC analog output such that when the bodymaker is running at the speed entered in "Trimmer Maximum Speed", the analog output will be at 10 volts. This is typically set to the running high speed of the Bodymaker or slightly higher.

**Trimmer Idle Speed (CPM):** This parameter determines the speed the trimmer will run at when the bodymaker is stopped (de-clutched).

**Note:** When the bodymaker is running, the trimmer speed reference is proportional (as set by the "Trimmer Maximum Speed" scaling) to the speed of the bodymaker. This parameter is used to provide the speed reference when the bodymaker speed is zero.

**Bodymaker Running Speeds:**

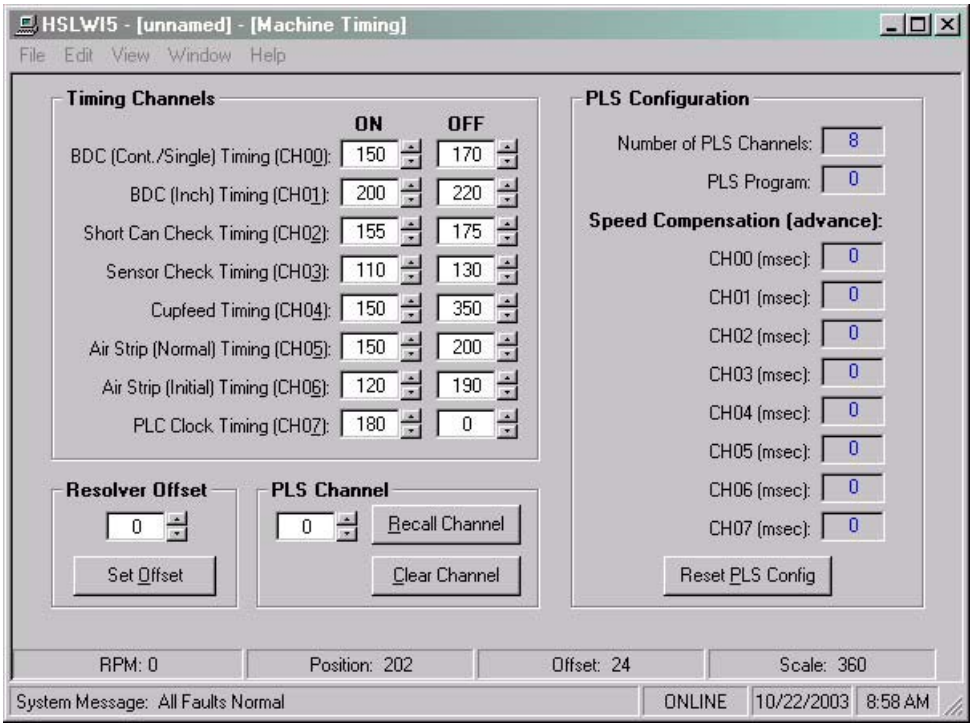
**Running Bodymaker Low Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run when in low (inch) speed.

**Running Bodymaker High Speed (SPM):** This is the speed (in strokes per minute) the bodymaker will run when in high (cont./single) speed.

## 4.5.3 THE MACHINE TIMING WINDOW

The Machine Timing window is used to invoke the PLS programming command menus. From this window, the user can view or adjust the following parameters:

- Adjust Timing Channel set-points.
- Set the Main Crank resolver offset.
- Clear or Recall a PLS timing channel.
- View the current PLS configuration
- Reset the PLS configuration to default settings.



In addition, the following parameters are displayed at the bottom of this window:

**RPM:** This is the current speed in "Revolutions per Minute" of the main crank resolver.

**Position:** This is the current "Position" in degrees of the main crank resolver.

**Offset:** This is the current resolver offset (set in degrees).

**Scale:** This is the scale factor of the resolver or the number of divisions in one revolution.

**Note:** Section 5 – General Timing Signal Locations, provides a complete description of each timing channel signal.

**Zeroing Machine (set resolver offset):** To set machine zero, perform the following:

1) From the "Window" menu, select "Machine Timing".

2) From the "View" menu, select "Online Data". The set-up program will attempt to communicate with the processor and place the system into an "Online" mode of operation.

3) Observe the "Position" field at the bottom of the window. Verify that as the machine is rotated forward, that the position increases linearly from 0 through 359 degrees. If not, swap the S1 and S3 leads at the resolver connector on the M4500. Then, verify that the position does indeed increase with forward movement.

4) Position the machine at back dead center.

5) Auto zero the resolver by entering "0" in the "Resolver Offset" field and clicking the "Set Offset" command button. A message box will appear, prompting the user to confirm their choice. Select "Yes" to set the resolver offset.

6) The M4500 will calculate the actual offset value required to make this the "0" position. The new offset value will be displayed in the "Offset" filed and the position will then read zero.

**Adjusting the Timing Channel Set-points:** To set any of the timing signal set-points, perform the following:

**Note:** Any changes made to the timing channel set-points will be saved as part of the setup data file.

1) From the "Window" menu, select "Machine Timing".

2) From the "View" menu, select "Online Data". The set-up program will attempt to communicate with the processor and place the system into an "Online" mode of operation.

3) Set all channels per section 5 – General Timing Signal Locations. Set-points for a particular channel are either entered in the field or adjusted by using the increment/decrement controls.

   **Note:** Only one set-point is used per channel.

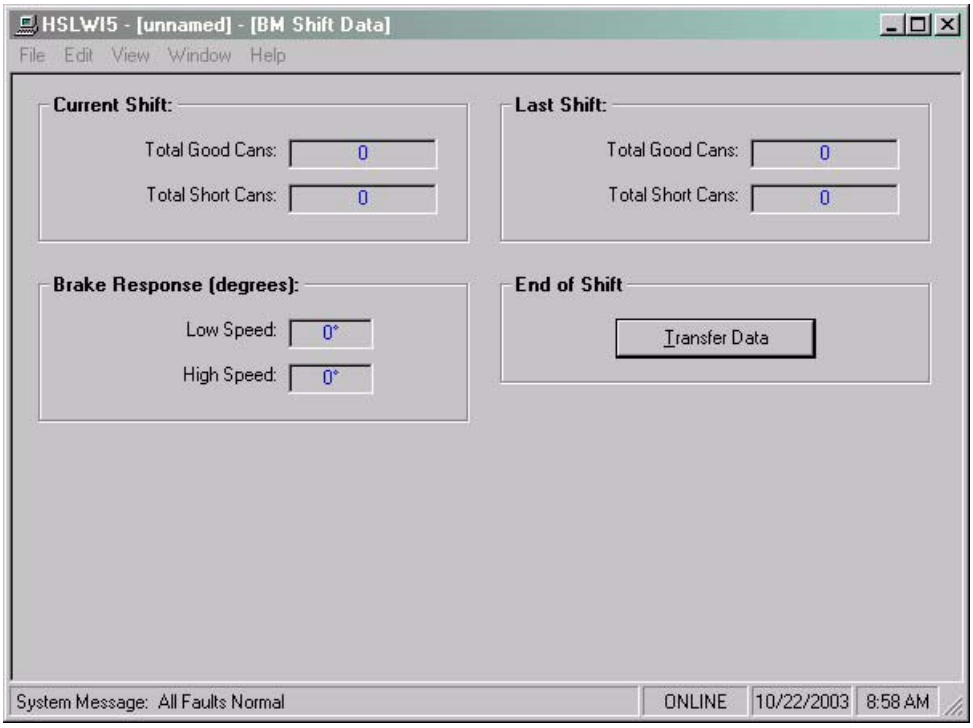
4) If a channel needs to be "Recalled" or "Cleared", enter the desired channel number into the "PLS Channel" field. Click the "Recall Channel" command button to recall the set-points. Click the "Clear Channel" command button the completely clear all set-points for the selected channel.

   **Note:** If a channel has been cleared or the "On" and "Off" set-points have the same setting, the set-point will be displayed as "*****".

**Resetting the PLS Configuration:** As an aid to the user the current PLS configuration is displayed as part of this window. The PLS configuration should only need to be reset if a new module has been installed. To reset the PLS configuration, click the "Reset PLS Config" command button. This function only resets the PLS configuration to the default settings for the bodymaker.

### 4.5.4 THE SHIFT DATA WINDOW

This window is used to view the Current Shift data, Last Shift data, Low and High speed brake responses and to invoke the "End of Shift" data transfer.




**Note:** Prior to selecting this selection, make sure an RS-232 SYSdev cable is connected from the COM port on the computer to the PROG port on the M4500. The following data is displayed in this window:

**Current Shift - Total Good Cans:** This is the total number of good cans produced so far into the current shift. This is essentially a can counter.

**Current Shift - Total Short Can Faults:** This is the total number of short can faults that have occurred so far into the current shift.

**Last Shift - Total Good Cans:** This is the total number of good cans produced in the last (previous) shift. This is essentially a can counter.

**Last Shift - Total Short Can Faults:** This is the total number of short can faults that occurred in the last (previous) shift.

**Note:** The current shift data is transferred to the "Last shift" data when the end of shift input transfers from a "0" to a "1". This can be at the end of either an 8 or 12-hour shift. This data can also be reset from this menu by clicking the "Transfer Data" command button.

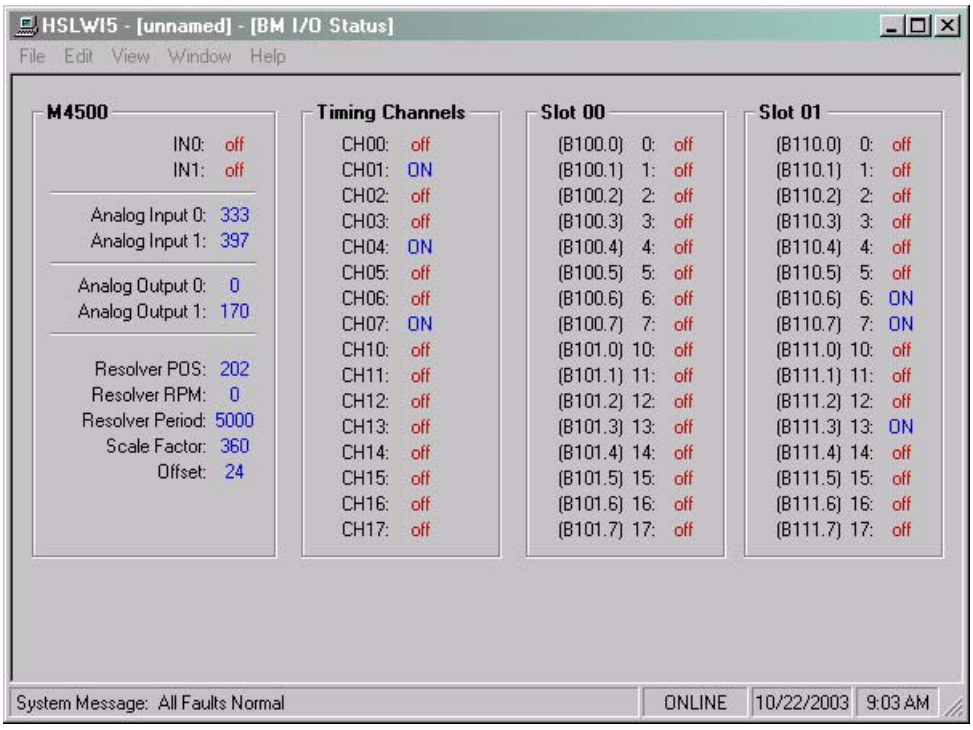
**Lo Speed Brake Response (degrees):** This is the number of degrees from the when the clutch was de-activated (at the BDC (Lo) timing) to where the bodymaker crankshaft came to rest when a BDC stop was performed at Low speed. This can be used to determine the general condition of the brake and whether servicing of the brake is required.

**Hi Speed Brake Response (degrees):** This is the number of degrees from the when the clutch was de-activated (at the BDC (hi) timing) to where the bodymaker crankshaft came to rest when a BDC stop was performed at high speed. This can be used to determine the general condition of the brake and whether servicing of the brake is required.

**Note:** The brake response for both high and low speeds is updated after each BDC stop.

### 4.5.5 THE I/O STATES WINDOW

The "I/O States" window is provided to display states of the inputs and outputs. The control boards, the states of the timing channels, as well as states of the M4500 are shown. This includes the interrupt inputs (IN0 and IN1), the analog I/O and the resolver. These values are displayed as read by the M4500 processor.



# SECTION 5
# GENERAL TIMING SIGNAL LOCATIONS

The following is a general description of the timing signals and the locations they should be set at:

**CH00: BDC (Cont./Single) Timing:** This signal is used to de-activate the clutch for a BDC stop at high speed (continuous and single modes).

**Note:** The leading edge is used to de-activate the clutch, thus the width of the signal is not critical (generally set 20° wide). When the brake wear compensation is enabled, this signal is adjusted automatically by the M4510. If the brake wear compensation is disabled, this signal must be set manually. In this case is should be set such that the press stops at back dead center for a BDC stop at high speed.

**CH01: BDC (Inch) Timing:** Same as the BDC (Cont./Single) timing (CH00) except used when the machine is activated in "Inch" mode.

**CH02: Short Can Timing:** This signal is used to verify the length of the can and verify that the can is good. The short can sensor must "see" can the entire time this signal is "ON" to prevent a short can alarm. This signal is generally set in the range of "on" at 150° to 160° and "off" at 170° to 175°.

**CH03: Sensor Check Timing:** This signal is used to verify that the short can sensor does not fail "ON". The short can sensor must be "off" the entire time this signal is "on" in order to prevent a "Die Sensor Fail" alarm. This signal is generally programmed to be "ON" just prior to the punch emerging from the die set, on the forward stroke (typical "ON" at 110° and "off" at 130°).

**CH04: Cupfeed Timing:** This signal is used to activate the cupfeed "ON" when enabled and back "off" when disabled. The leading edge of this signal is used to activate the solenoid "on" while the trailing edge is used to activate it "off". The "ON" set-point is generally set such that when the cupfeed is opened, the cup will drop onto the high part of the rotary cam. The "off" set-point is generally set such that the cupfeed will close such that the cup is caught with-out causing damage to the cup that is retained. This signal is generally set "ON" at 150° and "off" at 350°.

# SECTION 5
# GENERAL TIMING SIGNAL LOCATIONS

**CH05: Air Strip (Normal) Timing:** This signal is used to activate the air strip solenoid once the machine has established "Normal" production. The "Air Strip" is "ON" for the entire window that CH05 is "on" while the machine is running with the cupfeed open. This signal is generally set "ON" about 150° and then set "off" at about 200° (see section 2.7.8).

**CH06: Air Strip (Initial) Timing:** Same as the Air Strip (Normal) timing (CH05) except used when the machine is first initiated into production (see section 2.7.8). This is generally set "ON" about 120° and then "off" at about 190°.

**CH07: PLC Clock Timing:** This is a general purpose, timing signal available for use by existing PLC for whatever purposes necessary. This signal is not used by the M4500.

# SECTION 6
# RECOMMENDED SPARES

The Following are recommended spares for the HSL-WI5. These parts are available through Systems Engineering Assoc. Inc.

| Quantity | Part Number | Description |
|---|---|---|
| 1ea. | M4500 | PLC/PLS Processor/Chassis – 4 Slot |
| 1ea. | P4500 | Power Supply |
| 1ea. | S4563 | 16-point, 10-30VDC Input Board |
| 1ea. | S4573 | 16-point, 10-30VDC Output Board |
| 1ea. | D4591 | Keypad/Display |
| 1ea. | RSV34-MS1 | Resolver with MS Connector |