Addendum - SmartPAC PRO Advanced Die Protection Features

SmartPAC PRO Firmware Versions 7.80 and higher include a sweeping set of additions and improvements for the SmartPAC PRO DiProPAC. We have streamlined the way we handle sensor names, expanded the enable mode selection, added new capabilities to the Yellow, Red, and Green sensor types, and added a new customizable Green Sensor type called the Green Flex. These changes are described in this addendum

Sensor Names

The first step when programming a die protection sensor is to name it. Previous versions of SmartPAC firmware provided the user with a long list of "canned" names as well as 16 names that could be customized. The custom names were set in the initialization menu, and all names were available in all tools, requiring the user to scroll through the entire list of canned names (many of which are seldom-used) to select an appropriate sensor name.

In the new firmware, we trimmed the list of canned names to include just a few commonly used selections and allow an unlimited number of custom names. To streamline the interface, users are no longer required to set the custom names in the initialization menu – They can be set in the program mode while programming the sensor. When creating a custom name, the user can decide whether the name will be used only for that tool, or if it will be put into the "global" list and available for all future programming.

Here is the process for creating a custom name:

1. Turn the key switch to PROGRAM and create a new tool or select a tool to edit.

2. Select DIE PROTECTION and then any sensor, and the sensor name screen will appear, showing the reduced list of canned names and any custom names that have been created either globally, or for this tool number. The buttons for the canned names are dark grey, the custom name buttons are lighter grey. (see Figure 1).

3. If an appropriate name is in the list, simply select it. If not, press the NEW ENTRY button. This will bring up the on-screen keyboard where you can create the custom name (up to 17 characters including spaces).

4. After you enter the custom name, a dialog box will give you the option of adding the new name to the global list (where it will be available to all sensors on all tools) or just using it for this tool. If you are likely to use the name on other tools, make it global by pressing "Yes". If the name is tool-specific, select "No" to keep it local to that tool (see Figure 2).

Figure 1- The sensor name screen showing the reduced list of canned names and the NEW ENTRY button for creating a custom sensor name

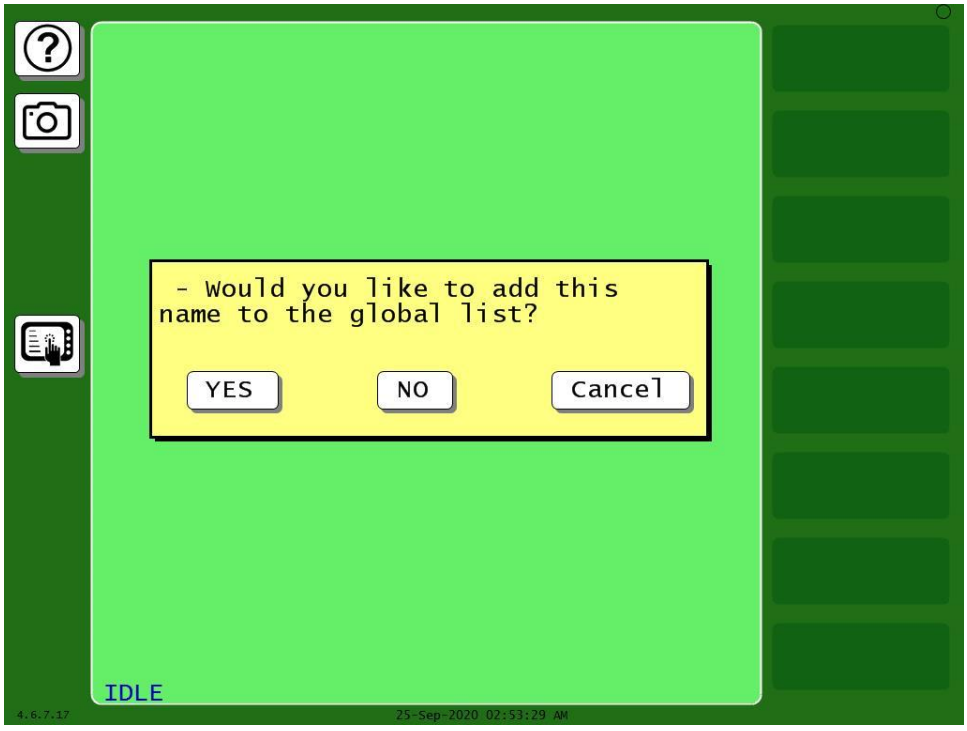

Figure 2- This dialog box allows you to add the custom name to the global list (YES) or only use it for the current tool (NO)

Enable Mode Selectable by Tool

The sensor enable mode has always been set in initialization. The selections are Manual, Auto by Tool, and Auto by Sensor. In previous versions of SmartPAC PRO firmware, this was a global setting – all tools used the same enable mode. In this and future releases, the enable mode selection in initialization is the default mode, which can now be changed and set by tool in the programming mode (see Figure 3- The main die protection programming screen with the enable mode selection at the bottomFigure 3).

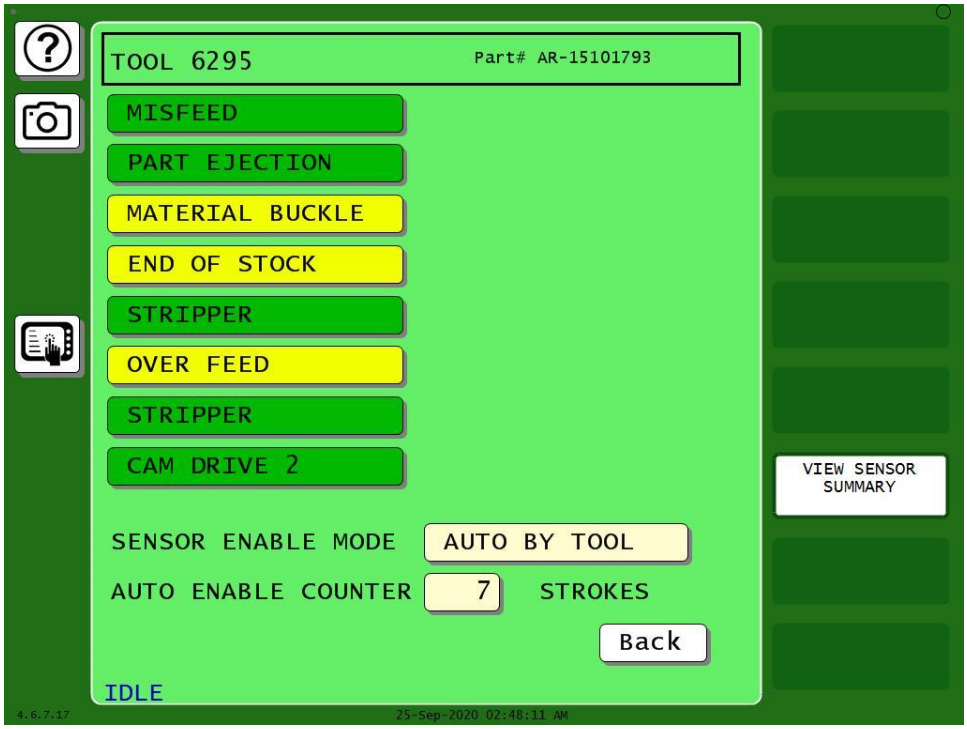

Figure 3- The main die protection programming screen with the enable mode selection at the bottom

Improvements to Red and Yellow (Static) Sensors

Static – Red and Yellow – sensors are easy to program: First name the sensor, select Red or Yellow, and select the stop type. Their operation has always been simple too: If a Yellow sensor turns On, or a Red sensor turns Off, the press stops. Beginning with SmartPAC PRO firmware version 7.8, new capabilities have been added to the static sensor monitoring logic to greatly increase their versatility.

AUTO RESET

Many had-fed operations use Red (normally closed) sensors to ensure the part is properly placed in the die. When the part is in place, the Red sensors are "On", and the press is allowed to run. However, each time the operator removes the finished part, a fault occurs, requiring the operator to reset the error on every stroke. This isn't really an error; it's a normal part of the operation.

For such applications, an "Auto-Reset*"* function has been added to the static sensors. When Auto Reset is enabled for a sensor, the error is automatically cleared when the sensor input is appropriately satisfied. Under the scenario described above, the sensor would display a fault (and the stop relays would open) when the operator removes the part, but would automatically reset the fault (and close the stop relays) when the new part is properly in place – negating the need for the operator to press Reset before stroking the press.

Under normal operation, the sensors function as they always have. When a fault occurs, the press stops. Fault messages are recorded in SmartPAC PRO's Event Log, so if an error automatically clears before the operator has a chance to see it, it can be found there.

The Auto Reset capability can be enabled from the sensor's program summary screen. The default setting is "disabled".

BYPASS ANGLE

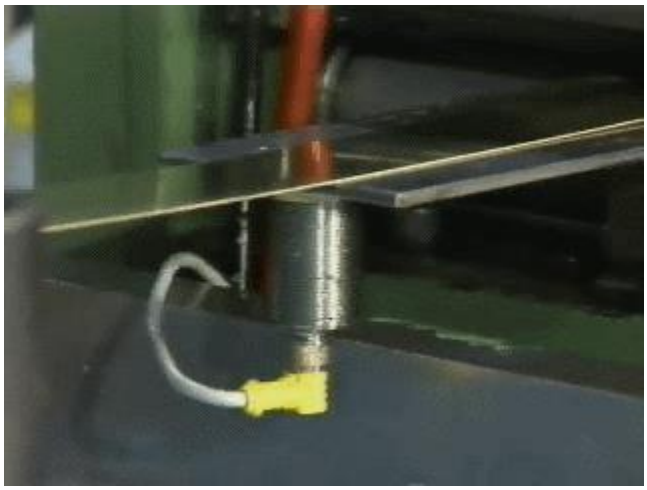

Figure 4- A Bypass Window on this sensor can eliminate nuisance stops caused by the material "jumping" when the die opens

The photo in Figure 4 shows a proximity sensor being used to monitor material buckle. When the material is near the sensor (not buckled) the sensor is ON, so it is set up as a Red sensor. The problem is that sometimes when the die opens, the material jumps off the sensor enough to cause a nuisance stop.

We fixed this by adding the capability to program an optional Bypass Window for static sensors (see Figure 5). During the bypass, the sensor will be ignored, so any nuisance fault during that window will not stop the press. Outside of the bypass window, the sensor is monitored normally.

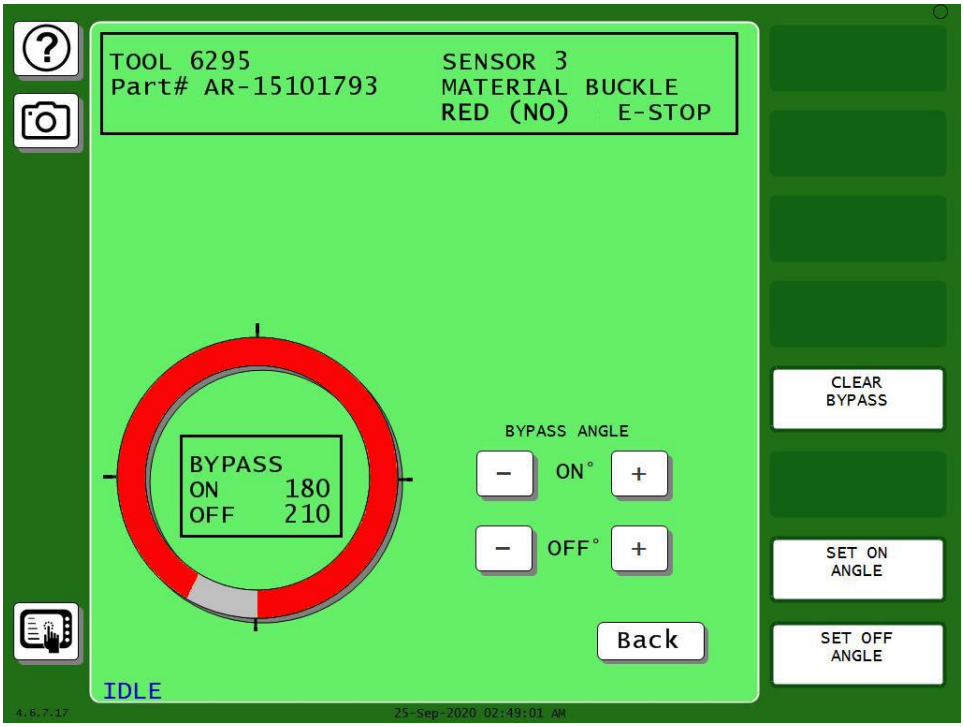

Figure 5- This Yellow sensor bypassed from 180⁰ to 210⁰. Actuations occurring during that window will be ignored

The bypass window can be added on the sensor programming summary screen (see Figure 6). The default setting is for no bypass angle. If a bypass angle is required, press the ADD button to program a bypass. To remove a previously programmed bypass from a static sensor, press the "CLEAR BYPASS" button on the bypass angle programming screen (Figure 5). This will remove the bypass window and return the "ADD" button on the sensor programming summary screen.

MINIMUM ACTUATION TIME

The Bypass Window is effective when you know the approximate angle during which a nuisance fault can occur. For applications that experience nuisance faults on static sensors at random times during the stroke, we have added a "Minimum Actuation Time" for the static sensors. This feature enables the DiProPAC to ignore short actuations of static sensors but will stop the press when a fault persists for longer than the specified minimum actuation time. The value can be set from 10 to 2500 mSec. The default value is 0, which turns this feature off.

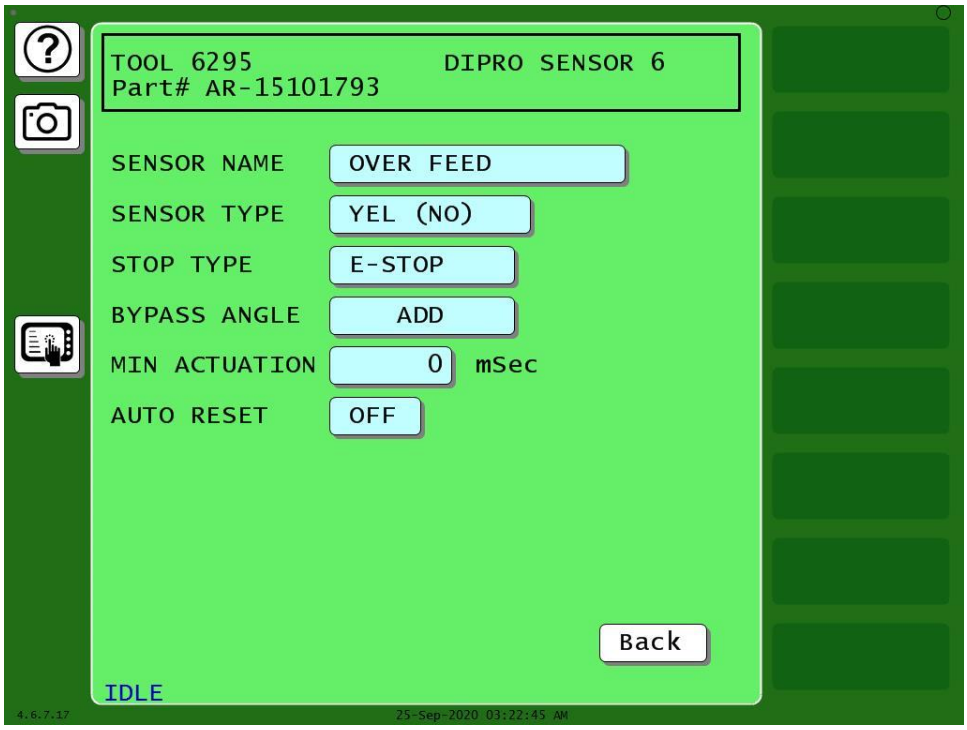

Figure 6- The sensor programming summary screen for a Yellow sensor showing the bypass, minimum actuation time, and auto reset settings

PLEASE NOTE:
These new features, while useful, will likely not be employed for most static sensor applications. Therefore, they will not be included in the normal program "flow" when setting up a static sensor. Instead, they are available on the sensor programming summary screen that displays when the sensor programming is complete. They default to the "off" condition. When needed, these items can be added from the sensor summary screen.

Improvements to Green (Cyclic) Sensors

There are significant additions to each of the Green (cyclic) sensor monitoring logic types. There is also a new user-customizable Green sensor type called the Green Flex.

INDEPENDENT READY SIGNALS FOR ALL GREEN SENSORS

Previous versions of the DiProPAC-32 required that any "green" sensors connected to inputs 17-32 re-use a ready signal from an existing sensor connected to inputs 1-16. This limitation no longer exists with the SmartPAC PRO and DiProPAC-32. All green sensors can now have independent ready signals.

STARTUP COUNTER FOR GREEN SPECIAL SENSORS

In some applications, it is necessary to delay the monitoring of a Green Special sensor upon startup. An example would be when a sensor is using the green special sensor type to monitor parts or slugs coming out of the press on a conveyor. You might want to verify that something is coming out of the press every 5th stroke, but it takes ten strokes after startup for the first part to reach the end of the conveyor where the sensor is located.

In this example, you would set the Green Special counter to 5, and the startup counter to 10 (see screen shot below). The startup counter default value is 0. To use the feature, simply plug in a number, setting it back to 0 turns the feature off.

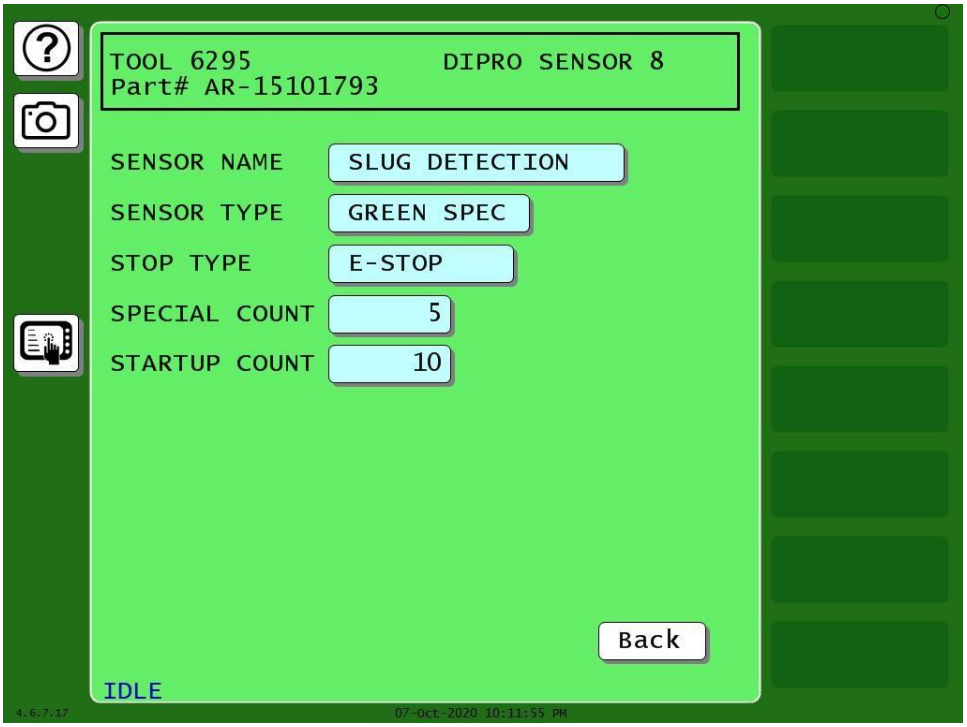

Figure 7- Green Special Sensor with Startup Counter

MASKING

It is occasionally necessary to use die protection sensors to monitor events that occur regularly but not on every stroke. Applications that use gagging, zig-zag feeds, or where multiple cycles are needed to produce a part feature events that need to be monitored on certain cycles and ignored on others.

A new "masking" feature is available on all green sensor types (except the Green Special). The masking feature is not part of the normal programming "flow" for the green sensors. Instead, it shows up as a selection on the sensor summary screen. The default is "DISABLED". When masking is disabled, the green sensor is monitored on every stroke.

Here is an example of how the masking feature might be used:

A part requires four press cycles to be produced. On the 4th cycle, a cutoff punch is gagged in, and the finished part is cut off the strip and falls onto a conveyor. The part ejection sensor detects the part as it drops onto the conveyor during the upstroke.

If an unmasked standard Green sensor type is used for this application, it would generate an error on three out of four cycles, so masking is required. The ready signal is set to ON @ 213º and OFF @ 318º, and the sensor is set to emergency stop the press when a fault is detected.

Here's how the masking would be used for this application:

1. On the sensor summary screen (Figure 8), enable masking by pressing the DISABLED button. Three new selections appear: MONITOR FOR, MASK FOR, and PRELOAD (see Figure 9).
2. You can set whether you want to monitor first or mask first by pressing the "SWITCH ORDER OF MONITOR/MASK" button.

3. In the example application, four strokes are required to make the part, with the part being cut off on the 4th stroke, so the masking should be set to MASK FOR 3 Strokes, MONITOR FOR 1 Strokes, with 0 PRELOAD strokes.

Figure 8- Sensor Summary Screen showing the Masking feature disabled. This is the default setting.

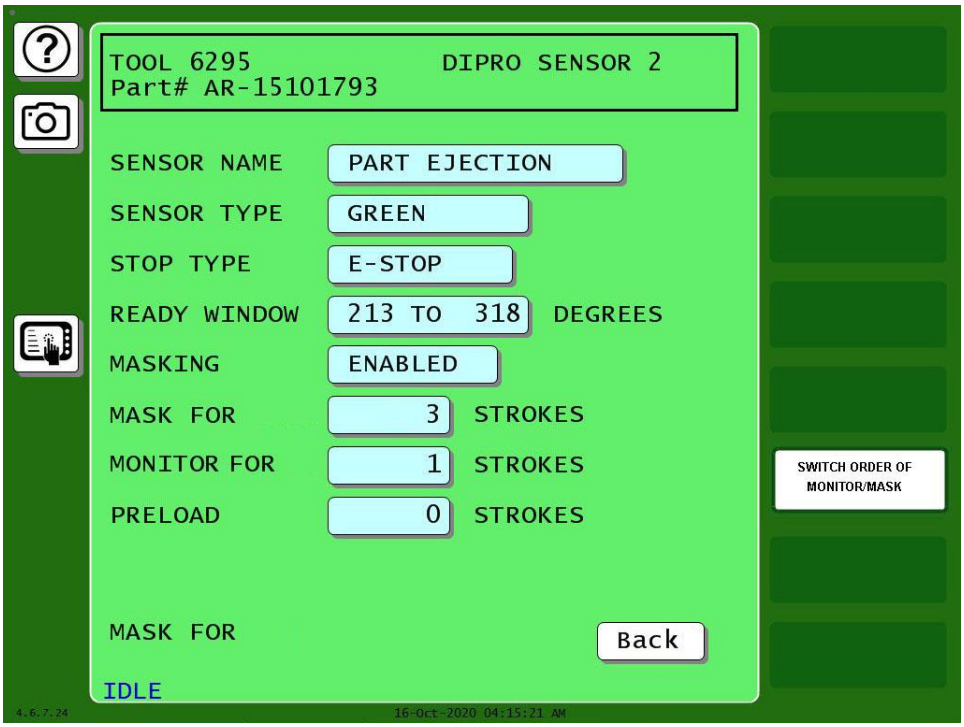

Figure 9- Standard Green sensor type with masking enabled. This sensor will check for part ejection every 4th stroke

GREEN FLEX SENSOR TYPE

We have created a versatile new cyclic sensor monitoring type called the Green Flex. In addition to the standard green (cyclic) sensor requirements – i.e. it must turn on sometime during the ready signal and turn off somewhere outside the ready signal – there are four new conditional options:

- You can specify the required state of the sensor at the start of the ready window. The choices are "Sensor must be ON", "Sensor must be OFF", or "Sensor can be either ON or OFF".
- You can specify the required state of the sensor at the end of the ready window. The choices are "Sensor must be ON", "Sensor must be OFF", or "Sensor can be either ON or OFF".
- You can set the sensor to require a specific number of actuations inside the ready window.
- The masking feature (described above) is included.

The following examples show where these features can be useful.

The Green Flex is useful for feed detection on a higher speed press. In this case, the end of the ready signal is used to verify that the strip has fully fed, and the start of the ready signal is used to detect feed slippage at the start of the feed on the next cycle. Using the Green Flex sensor type, set it so the sensor "Must be OFF" at the start of the ready (to verify that the feed started) and "Must be ON" at the end (to verify that the strip fed).

Set the ready signal OFF angle for when the feed cycle is supposed to finish, and set the ON angle for shortly after the feed is supposed to start on the next stroke, so if the feed slips at the start of the feed cycle (by far the most likely time for it to happen), the press can be stopped while there's still time.

Figure 10- The programming summary screen for a Green Flex Sensor

In some dies, there are several strip features that will actuate a sensor as they pass by during the feed. For example, if the part has a row of four holes, the last of which is being used to indicate full feed progression, you can set the sensor to be a Green Flex, set the number of required pulses to 4, and set it so that it "Must be ON" at the end of the ready signal.

The feed must fully advance for this sensor input to be satisfied. Doing it the old way with a Green Constant opens the possibility of allowing the press to run with a partial feed if one of the holes happens to end up in front of the sensor.

Additional “SENSORS DISABLED” Indicators

Previously, if the sensors were disabled, a red SENSORS DISABLED message would flash in the status block on the main run screen. We have now added the flashing SENSORS DISABLED indication to all the run mode die protection screens (see Figure 11) so users can quickly identify the sensor status while they are adjusting the die protection sensors.

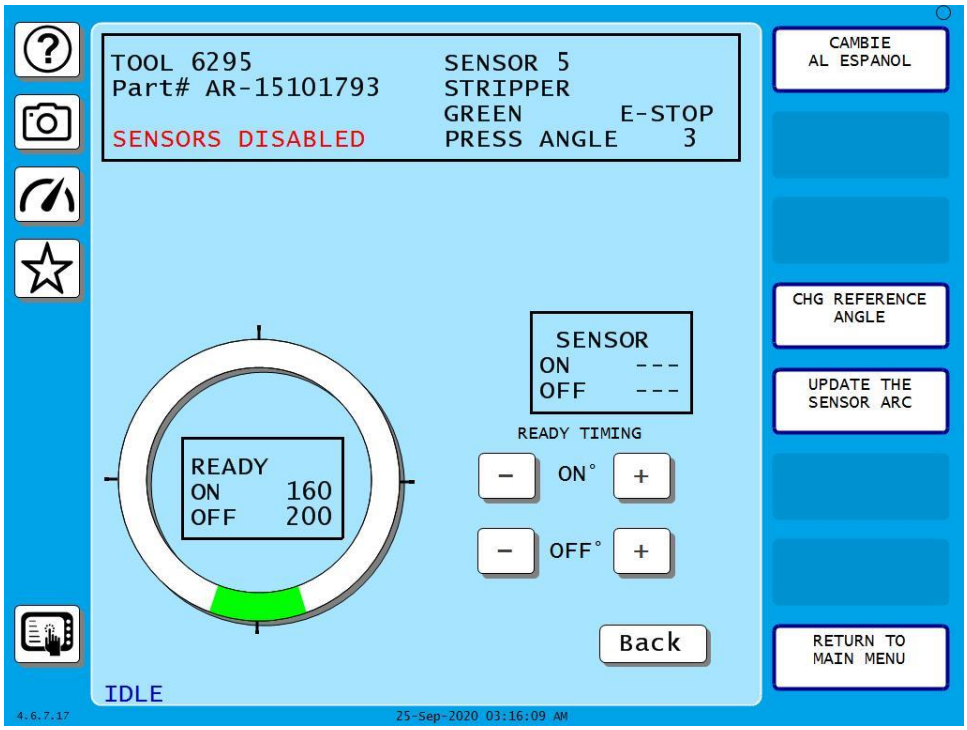

Figure 11- Sensors Disabled indication all Die Protection Run Mode screens

“Copy a Sensor” Button

To program a sensor, first you select the input, then name the sensor, then select the sensor type. There is now a COPY SENSOR function button on the sensor type selection screen. When selected, a list of previously programmed sensors shows up. Simply select an existing sensor from the list and the new sensor will copy the rest of the settings from the previously programmed sensor (except the name).

This is different than a “linked” sensor (like we used to use for sensors 17-32) in that the newly copied sensor can be adjusted independently from its “parent” sensor.

This feature is a timesaver in applications like stripper position detection and transfer, where many sensors share the same sensor type, timing, and stop type settings.

Figure 12- The sensor "type" screen showing the COPY A SENSOR button

Figure 13- The list of previously programmed sensors from which the timing and stop type settings can be copied to the new sensor