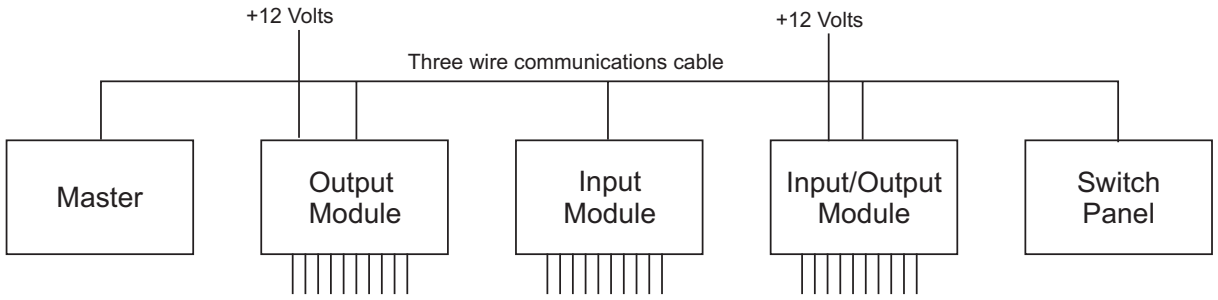
# Chapter 8

## Troubleshooting Diagnostics

# *Programmable Multiplex Control*
## *Trouble-shooting Guide*

The PMC Multiplex Switching Systems are different from conventional wiring systems, yet still fairly easy to trouble-shoot, should the need arise. With these systems, the power is supplied to switching/output modules and controlled and distributed from them. The switching modules are signaled from the switch panels and/or the CPU (Central Processing Unit), instructing them to turn the loads on or off.

***The following pages assume that the vehicle program, or booleans have been tested and that the program has been downloaded to the CPU successfully.***




Typical System Configuration
*Figure 1*

## *Trouble-shooting*

***IMPORTANT*** **1ST STEP**

Many of the problems often associated with a Multiplex Systems are attributed to the battery being nearly dead, therefore; the system is not performing as expected.

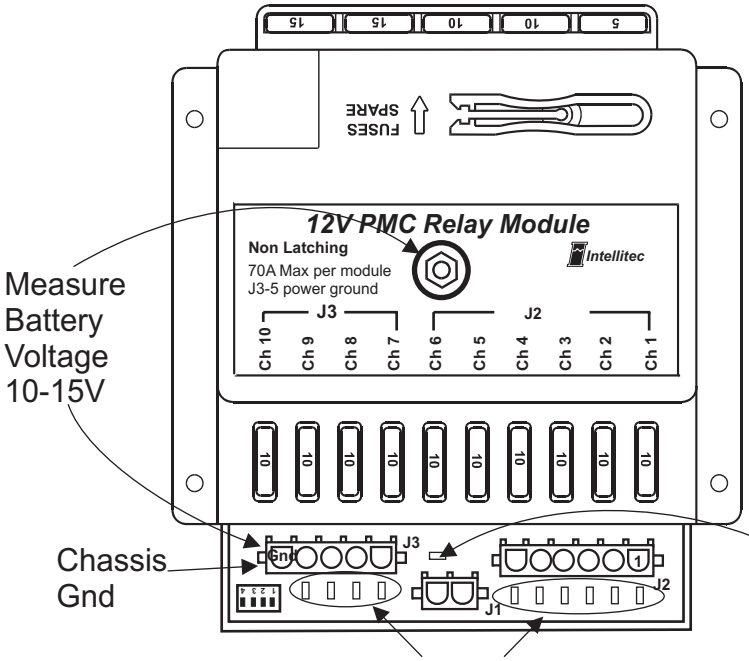
**Before proceeding with any other diagnostic measure, check the condition of the battery by measuring the voltage on the system.** *If the voltage is below 10 volts, or momentarily dips below 10 volts, recharge the battery.* The voltage may measure greater than 10 volts and then dip below when loads are turned ON. If this is the case, charge the battery. If the vehicle is a motor coach, connect the coach to shore power or start the generator to be sure there is enough power for the loads.

If the supply voltage is correct, define one of the following:

***Symptoms***

1. A single load is not operating properly.
2. All of the loads associated with a single output module are not functioning.
3. All outputs in the system are dead.
4. All outputs in the system are stuck ON.
5. None of the buttons, or switches on a single switch panel operate.

# Post Delivery
## Trouble-shooting Guide




Red Communications LED will light if power is present at the Module, ***but*** communications is bad. Modules whose part number begin 00-00846 have a green LED indicating that communications is OK.

Check for 7.5-9V at the communications connector. For this module, it comes from the two pin connector that plugs into J1.

See www.intellitec.com for module data sheets.

Diagnostic Load LED's will light if the output is ON and the fuse is good

***FIGURE 2***

### *A SINGLE LOAD IS NOT OPERATING PROPERLY*

If a single load is not operating properly, the first thing to do is to locate the Output *M*odule feeding that load. Once located, observe the ***green*** diagnostic LED on the *M*odule associated with that channel. Operate the switch to turn the load ON and determine if the LED is ON. *(See figure 2)* If it is *ON*, then the problems is with the load. Check the load and the wiring to it.

If the green LED is out, check the fuse associated with that load. Some output modules do not have fuses and have self protecting outputs check the module data sheet for additional diagnostic information. The fuse can be inspected with a test light or ohmmeter, or the fuse can be removed and checked visually. If the fuse is faulty, replace it and check for proper performance. If the fuse blows again, the problem is with the load, or the wiring to it. Check both the load and the wiring to it. Repair as necessary.

If the problem still exists, it may be with the switch panel and/or other inputs that are required by the programming. To determine if the switch panel is defective, or whether inputs are present, a Module Simulator or a System Status Monitor (available from Intellitec), can be used to verify if the proper inputs are present. This requires knowledge of what inputs are needed to turn the output on. If the problem is still not corrected, assuming that the proper inputs are present, the problem may be with the Module. To check the Module, remove and replace it with another that is addressed with the same address as the one taken out. Depending upon the module, addresses are set with either a dip switch or with jumpers.

# *Post Delivery*
## *Trouble-shooting Guide*

***NONE OF THE LOADS OF ONE SWITCHING MODULE ARE PERFORMING PROPERLY, OTHER MODULES are OK***

If all of the loads on a switching Module are not performing properly, locate that Module and observe the Communications LED on it. If the LED is out, check for 12 volt power on the power input stud located on the Module. If power is not available, locate the source of the power and correct the fault. Also check to be sure the Module has a good ground. This can be done by measuring the voltage on the ground pin of the Module relative to a known good ground. Consult the Module's data sheet to locate the ground pin.
Data sheets are available at *www.intellitec.com*.

If the *red communications* LED is *ON,* the Module is receiving power, but not receiving the communications signal. This problem can be caused by faulty wiring at the Module, at the point of signal origination, or points in between. To localize the problem, using a voltmeter, measure the DC voltage between the communications signal wire and the signal ground wire. (Usually a two pin connector) This voltage should be approximately 7.0 to 9 volts DC. If it is not in this range, then the problem is with the wiring from the source of the signal, which is the CPU module. The problem might be either with the signal wire, or the signal ground wire. The source of this problem can be located using standard techniques to locate the fault. Substitution of the wires from the source to the output switch Module may help to verify that the module is operating properly and determine which wire is at fault.

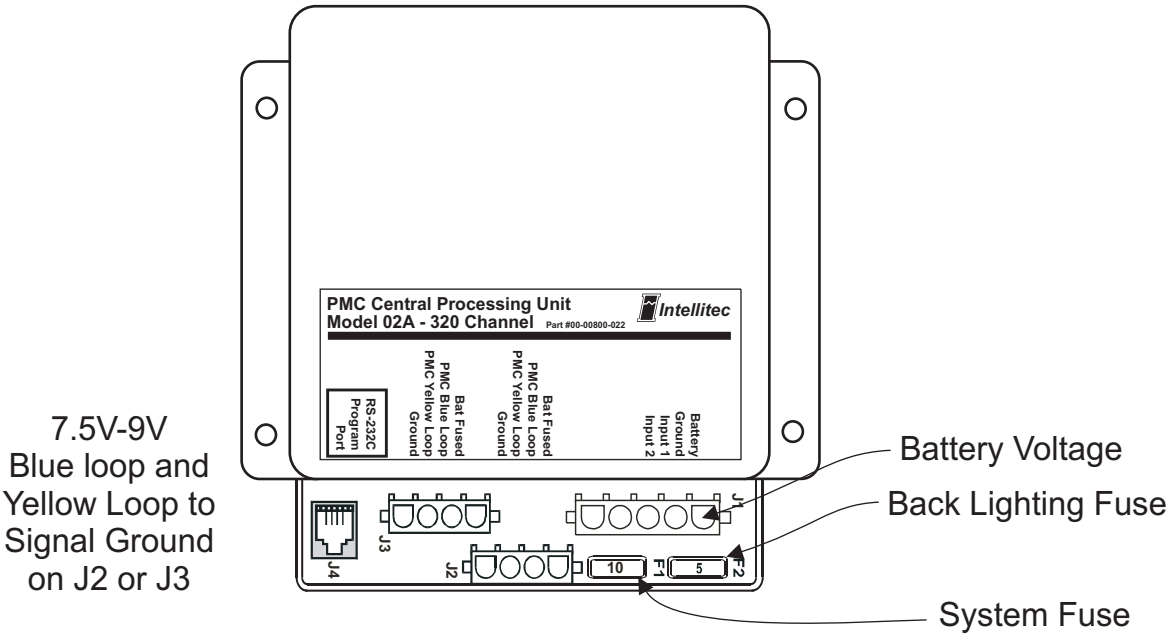



*Figure 3*

**Data sheets are available at *www.intellitec.com***

# *Post Delivery*
## *Trouble-shooting Guide*

### NONE OF THE SWITCHES OR BUTTONS OF ONE SWITCH PANEL WORK

Unplug the three-pin or four-pin plug from the switch panel or switch adapter. Using a voltmeter, measure the voltage from pin 1 to pin 3. You should measure battery voltage. Measure the voltage from pin 2 to pin 3. You should measure the communication signal of 7.0-9 volts. If you do not, check the wiring. If you do, try replacing the switch panel. A push button switch panel that has not been programmed will not operate any of the outputs. (***Push button switch panels must be programmed correctly at the factory***) If you find that the push button switch panel operates the wrong functions, it is likely that the switch has been programmed with the wrong button allocations, or is the incorrect panel for that location. Rocker switch panels must have their address set correctly via the dip switch or jumpers and J1 pin 4 must be connected to chassis ground.

### ALL THE OUTPUTS OF THE SYSTEM ARE DEAD

If all the outputs of the system are dead, this indicates either the battery voltage may be low, or a problem with the communications wiring. **First, using a voltmeter, determine that power is being applied to all the Modules, and the system fuse (F1) and the fuse (F2) for back lighting on the CPU Module are good.** Check the voltage on the CPU Module to ensure that the 12 volt power to the Module is present and the 7.0-9 volt signal voltage is present at the blue and yellow loop pins. On the 160 channel CPU, the signal voltage is measured from pin 2 of the 3-pin connector to pin 3. On the 320 channel CPU, communications is measured on the 4-pin connectors from pin 2 to 4 and pin 3-4. If the signal voltage is not normal, ***unplug all*** the communications wires from the CPU and measure the power and signal voltages available at the CPU again. If the voltages on the communications plugs are still not normal with all the communications wires unplugged (12 volts for power and 7.0**-** 9 volts for signal) and the fuses are good, replace the CPU module. **Make sure that the replacement has been programmed.**

If these voltages are normal, unplug the communications cables from all of the system Modules and reconnect them to the CPU. Measure the voltages at the CPU again. If the communications signal goes away, the communications wire in the harness is grounded and should be repaired. If you measure battery voltage on the communication wire, the harness is somehow connected to the battery; this fault should be corrected. In either case, communications is not working due to a problem in the harness.

If all the voltages check out, begin plugging the communications cables back into the Modules, one at a time, to determine which one loads the CPU. It is possible that one of the system modules is bad, or that one of the communications connectors to a module is pinned wrong. As you plug each Module in, you may notice that the system begins to work until the connector or module with the fault is plugged in. When the faulty Module or plug is identified, leave it disconnected and continue until all Modules are connected. It is likely that you will find that the system is functioning. Plug the suspect Module back in. If the system goes down, check the wiring at the plug to see if it is pinned wrong. If the wiring is ok, replace the faulty Module.

### ONE OR NONE OF THE BUTTONS ON A SINGLE PUSH BUTTON SWITCH PANEL OPERATE THE LOADS

If *one* of the buttons on a single switch panel does not operate, a Module Simulator can be used to determine if the switch panel is putting out a signal. If it is not, replace the panel. If *all* of the buttons on a single switch panel do not operate, the wiring to the switch panel may be faulty. Check the voltages on the three wires to be sure the 12 volt supply, the signal voltage, and ground are present. If they are not, repair the wiring. If they are and the panel still doesn't work, replace the panel with one that has been programmed the same as the original. If the push button panel operates the wrong loads, check the program in that panel.

# Trouble-shooting Diagnostics
## Communications

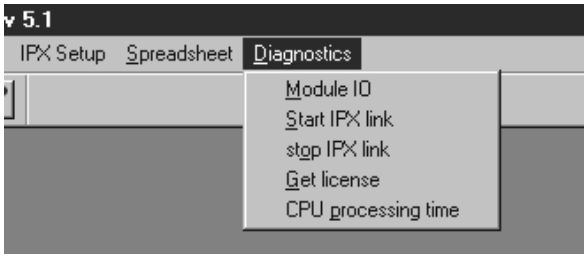
Module communications problems can be diagnosed with a voltmeter by measuring the voltage on the communication lines. Problems here can cause all outputs to be OFF, or all outputs to be ON.

Measure from the PMC ground wire to the PMC signal wire, pin 2-3 on the three-wire communications line at any module. This voltage should be approximately 7.0-9 volts. Also, measure battery voltage between the ground wire and the fused battery power wire from the CPU, pin 1-3 on a three-pin connector. *(See individual module data sheets for connectors and pins).* Most output modules have a two-pin communications connector. The LED's on the 00-00739-120 and 00-00739-240 *Module Simulator* can also be used to verify the proper voltages.

If the communications wire measures battery voltage, it will blind the system and nothing will respond to inputs. Check for a 3-pin plug that is mis-wired. If the communications wire is inadvertently grounded, or connected to ground through a resistance, outputs may turn on depending upon the output module. Check for mis-wiring of a communications connector. It is also common to find that a screw has shorted the harness to ground.

Assuming that the voltages are correct, you can move to diagnosing the software. The system has a number of tools to help you trouble-shoot the system in the event that it does not do what you expect. To enter the diagnostic mode, click on "Diagnostics".

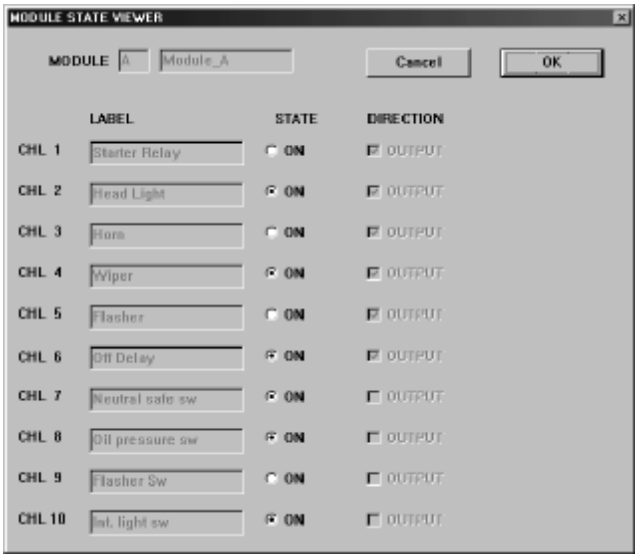
*The window flyout below shows the choices you have.*




***MODULE I/O***

Clicking on Module I/O will bring up a screen that allows you to select a module I/O to diagnose. Select the module you want and click on "OK". This will bring up a screen that displays the state of each channel, for that module.

From this screen, you can see if each channel is doing what you expect. If an output channel is marked with a dot and shown to be ON, but the output is not, check the fuses on the module or the wiring to the load. At the output, using your voltmeter or trouble light, you can check for voltage at the output module. If you change inputs to the system, you should be able see those inputs and any dependent outputs change. ***NOTE*** *your computer screen is not updated as fast as the PMC system, so you may see the dots appearance delayed from the actual event.*




**This screen is available on the 160 Channel CPU.**

If the output communication channel is ON, but the load is not, check the output module and load for problems.

This screen can also be used to determine if an input is present. If an output is programmed to come ON, if both ignition and the switch is ON, you can check to see if the system sees both inputs. If not, check to see if the input is attached to the proper connection on the input module. For inputs you will also want to check to see if the HI/LO jumpers are set correctly. If it is not convenient to connect a lap top to the system, the Module Simulator or System Status Monitor can be used as well.

**TROUBLESHOOTING DIAGNOSTICS COMMUNICATIONS** *(continued )*

***START PMC LINK / STOP PMC LINK***

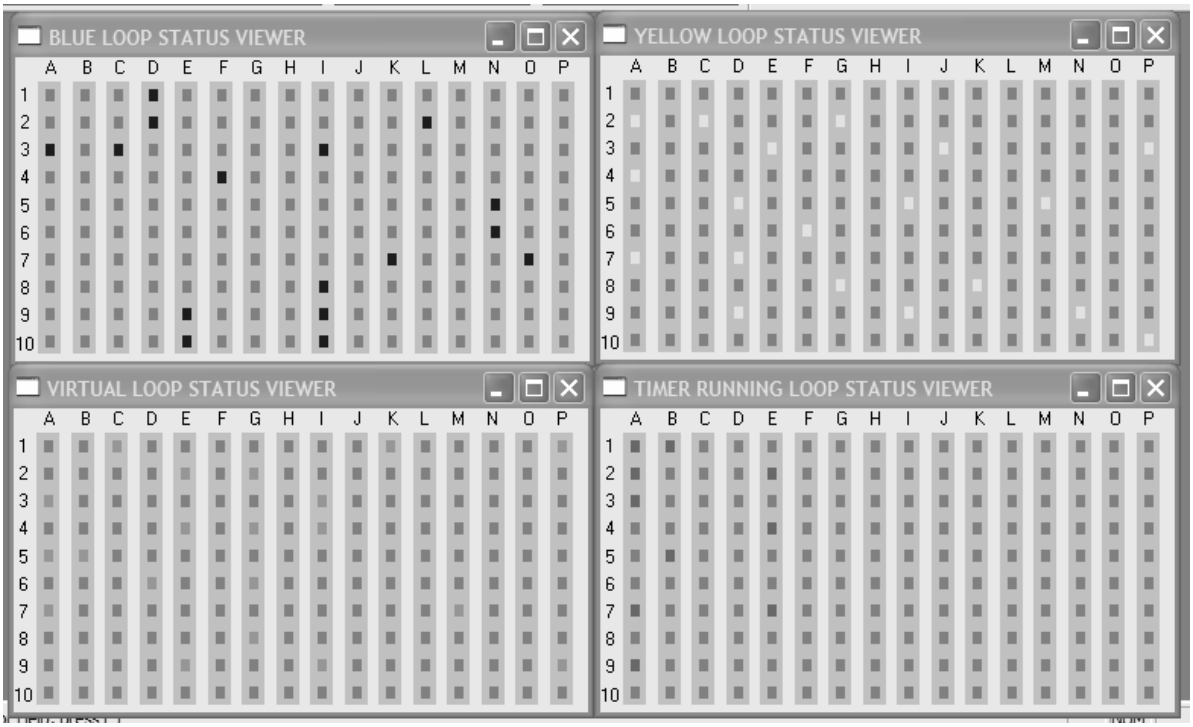
This command allows you to stop or start the PMC communications link between the modules of the system. ***This is not the serial link between your computer and the CPU.*** It could be helpful if something that the system has turned ON is being damaged. You may also want to stop the PMC link if you are programming with the port open, but do not want any of the outputs to turn on. If you select "stop PMC link", outputs that are ON will turn OFF and the system will no longer respond. You will be able to continue programming via the RS232 port. When you select "start PMC link", the system will come back to life. If you find that the system is not responding to inputs, select "start PMC link" from the diagnostics menu.

***CPU PROCESSING TIME***

This command allows you to see how much time the calculations of all the Boolean equations require. If this number exceeds 0.04 seconds, the calculations will exceed the time of one pass of the system. This will cause some of the actions of the system to be slowed.

# Diagnostics on the 320 Channel System

The 320 channel CPU has enhanced diagnostic capabilities. By clicking on the icon, the following screens can be opened on your laptop. In order to read the status of the channels, you must have the port open. Communications through the port is slower than PMC. You will see a slight delay when a channel is turned ON, before you will see it on the screen. These screens provide the same function as the system status monitor. In addition, they are also capable of showing the status of virtual and timer channels. This can help during initial programming. For example you could verify that the boolean for a virtual channel is working.



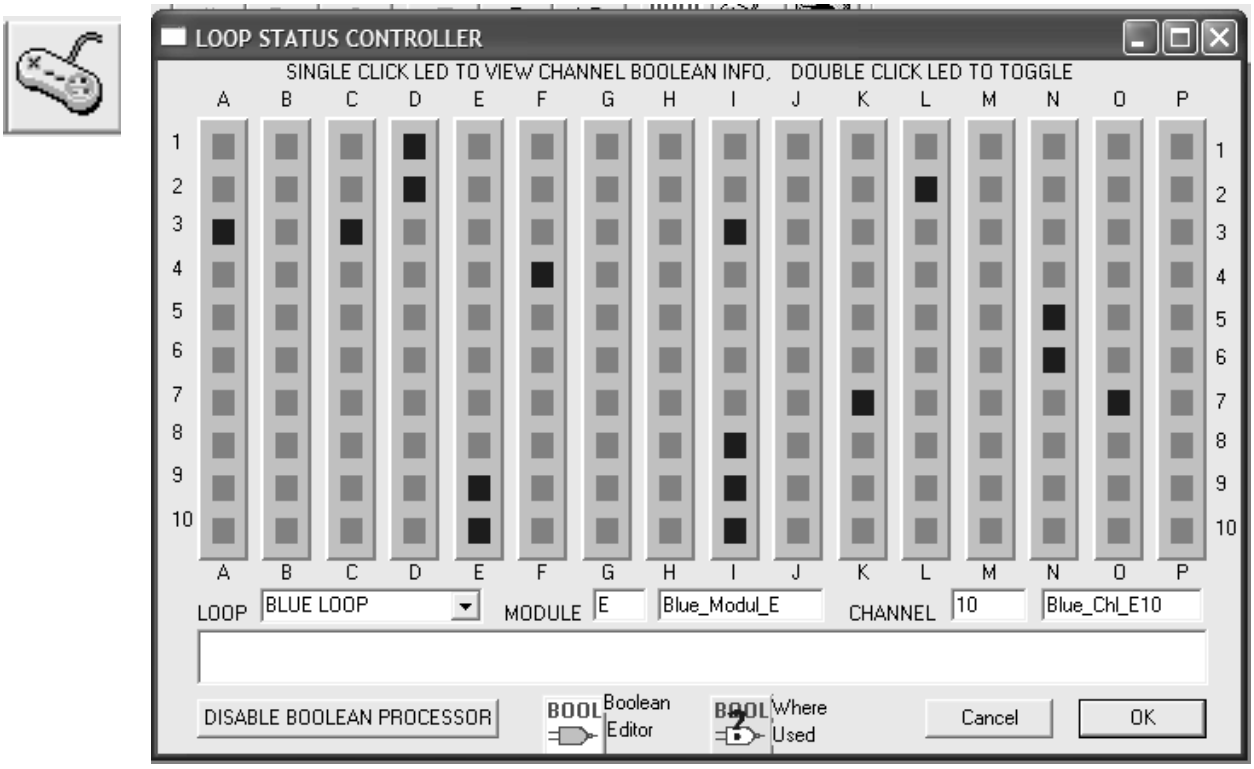
# 320 Channel System Diagnostics

### *LOOP STATUS CONTROLLER*

By clicking on the icon you can bring up the Loop Status Controller screens for each of the loops in the 320 channel CPU. In addition to providing the status of a communication channel, an output can be forced ON by clicking on "disable the boolean processor" and double clicking on the channel button.

A channel cannot be forced ON in this manner, unless the "Output Channel" box has been checked in the Boolean Editor screen. If a channel has been defined in this way as an output, it can be forced ON and OFF. The Boolean processor must be disabled by clicking on the box. If the boolean calls for a switch to be turned ON and the switch is in the OFF position, the boolean processor will turn the output OFF .040 seconds after you forced it ON.

This feature is useful to check if an output module is working when you can not physically reach the switch that turns it on.




### *TEST EQUIPMENT*

1. Module Simulator (Force inputs and outputs ON and determine Status of I/O)
2. I/O Status Monitor (Views 160 I/O points simultaneously)

***Contact Intellitec as new equipment may be available.***
*See Chapter 2 for available test equipment.*