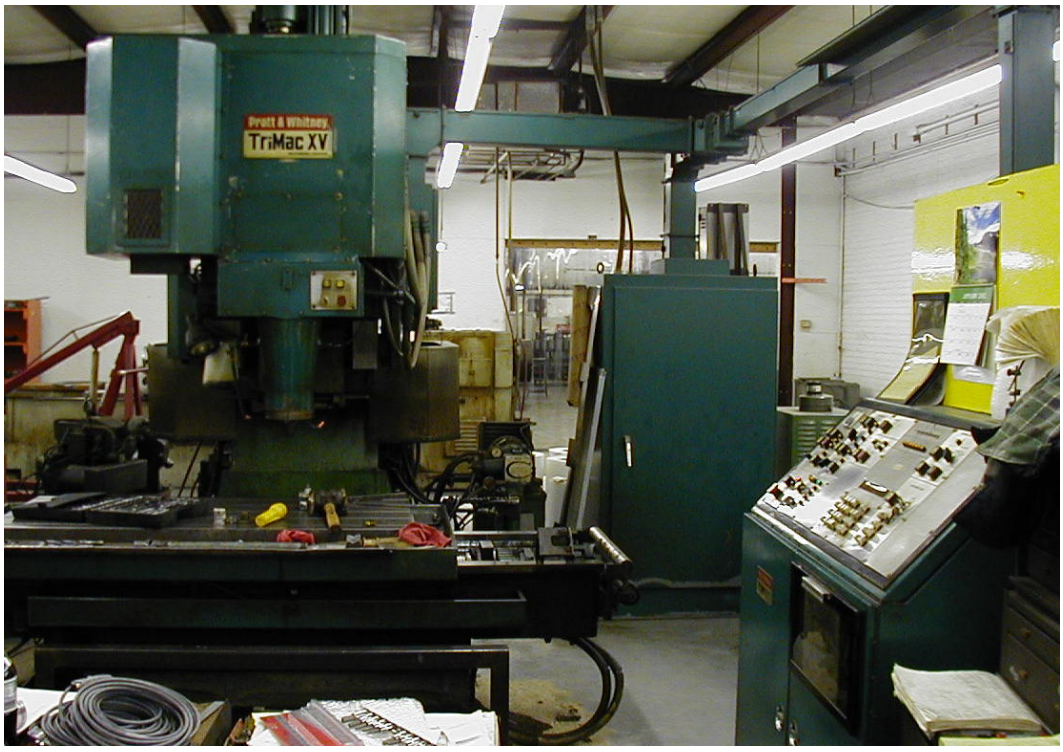
MACHINEMATE Retrofit Kit
For Pratt & Whitney Teammate Control

Mark Rice, based in Bedford, Texas, was a service representative for Pratt & Whitney machines from 1978 to 1984. This was during the oil boom when most of the machines with the Teammate control were built so he had personal experience with many of them. These machines are still in production although their maintenance became difficult. Not only was the control about 20 years old, but also its service was virtually impossible (since the support for the P&W controls had changed after several mergers so good service often required finding someone who used to work at P&W).

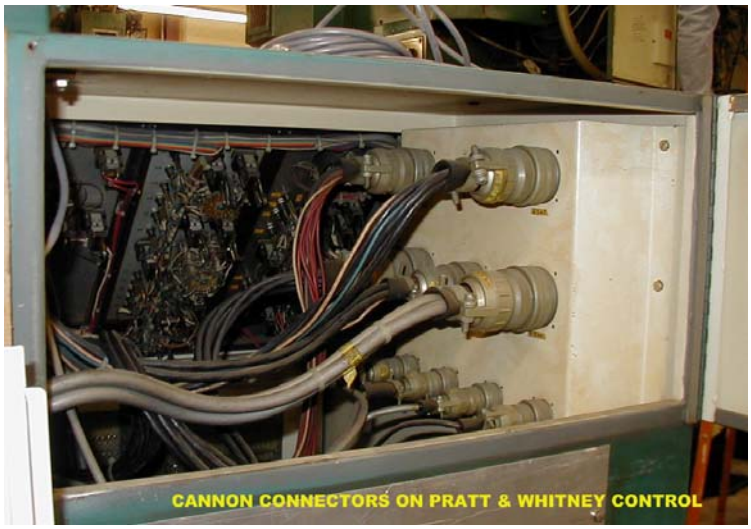
Mark expected that an easy 'plug and go' control retrofit could help many of these Pratt & Whitney machines return to production quickly and with the knowledge that future maintenance will be easier and less expensive. Younger operators are typically baffled by the old control. They simply cannot relate to it and usually do not want to learn how to operate it. Mark intended to bring in a PC-based **MACHINEM**ATE control that would be familiar to the entry-level workers since most of them know how to work Microsoft Windows. The new control is today's technology with the full range of support offered to a PC.

Pratt & Whitney had standardized their connections on many of their controls. For **MACHINEM**ATE retrofits on their machines, Mark was most concerned with the Teammate control (with a slope top) and the Teammate II control (an upright control with a plasma display). Both used the TI 960 mini computer for the control processor. Pratt & Whitney had also used several other vendor controls but the two Teammate controls are the target for this kit. The Pratt & Whitney TriMac XV machine with its Teammate control is shown below, before the control retrofit.

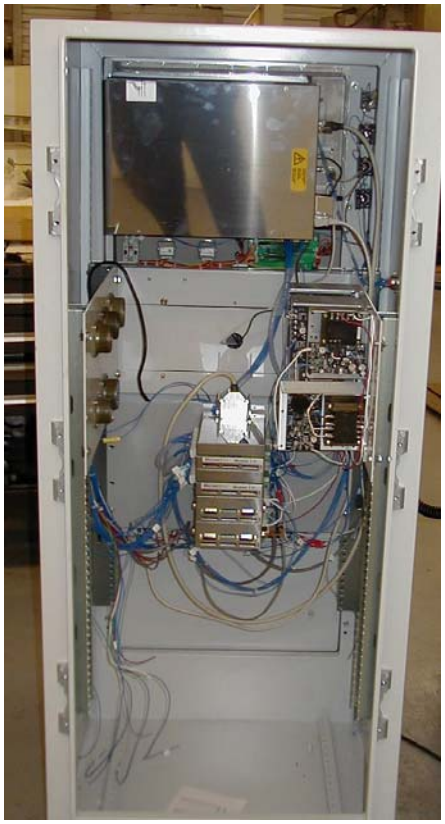


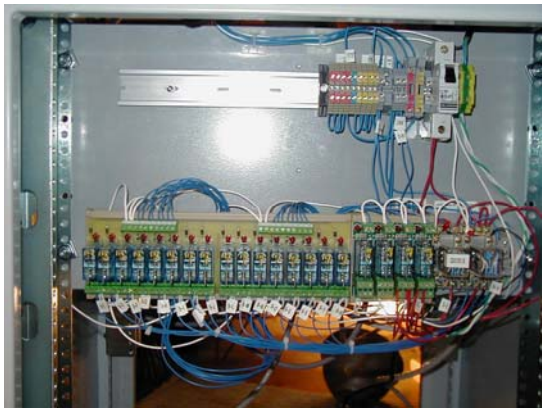
Retrofits of the known P&W machine configurations can be made very quickly. The complete procedure for the control retrofit and then checking the machine and control for their return to production can be completed in just a few days. All connections from the CNC to the machine tool

were made via Cannon connectors. These connectors are shown in the picture below, in the old control. This control retrofit is compatible with both P&W lathes and mills.



Machines with customer options should require no special wiring but they will require the development of the additional PLC logic to interface the option to the control. All input and output signals will be available for the base machine and most options.





The inside of the **MACHINEM**ATE cabinet is shown in the picture at the above left (taken during the control wiring phase). The back of the CNC is visible at the top (the industrial PC is the stainless steel enclosure, mounted on the back of the color display) and the **MACHINEM**ATE IO modules are

mounted on a sub-panel in the lower center of the cabinet. The connector plugs for the wiring to the machine are mounted on the left side within the cabinet. The DC power supplies are mounted on the right side of the cabinet, above the IO modules. Extra I/O can be added (if needed) with another MMIO module on the bottom of the stack. The AC isolation rack, with a number of breakers and fuses (shown in the picture above right), is mounted on the back of the MMIO sub-panel and is accessed from the door in the front of the cabinet, just below the keyboard.

Pratt & Whitney called their feedback devices 'quantizers' that were 12-15 volt single-ended feedback signals. Upgrading to encoders is recommended but an interface with the existing feedback devices is possible. Mark has developed a level shifting interface circuit that can convert these single-ended signals to the quadrature line driver signals compatible with the **MACHINEMATE** encoder interface. There are two benefits to upgrading to encoders: the new encoder devices are more reliable and the **MACHINEMATE** can detect a feedback failure with the new devices, which it will not be able to do with the old quantizers. The replacement of the encoders will add a little more time to the schedule mentioned above because their wires will have to be routed through the machine to the control. They also add to the retrofit cost since an encoder with the coupling and connector plugs that are bolt-in replacements is approximately $500. Also, new encoders can be obtained with finer resolution than the original devices providing better positioning feedback and smoother machining.

The replacement control with the **MACHINEMATE** is shown at the left. The handheld operator station with MPG is shown hanging on its bracket on the left side of the cabinet. The door to access the breakers and fuses is visible below the keyboard/mouse panel.

This customer chose to install an Ethernet network card in the **MACHINEMATE**. The operators can write and edit the part programs on the control but with the network connection they can also get the technical details and scheduling information for the parts themselves from the parts' customer. The **MACHINEMATE** control can run part programs from its internal memory but often the operators run the programs directly from the hard drive, with a much larger program capacity than found in the older memory-bound controls and with no practical limit on the size of an individual part program file.

Within one week after the installation, this customer had written and was running part programs for parts that could not be run with the old control. Also, the work offsets (G54-G59) will save the operators about one-half hour in setup time because they can save and recall the work offsets rather than having to indicate the part again for each position. The canned cycles allow parameters like the reference plane to be changed between each cycle position so the program can avoid the clamps that could be an obstacle between certain holes.

Below is the new **MACHINEMATE** control in its cabinet next to the original Pratt & Whitney Teammate control. The new Teammate control in 1977 cost approximately $50,000. The new control cabinet with the options shown is $23,000. In adjusted dollars, this is one-ninth the cost of the original control.

Before **After**

This is an easy 'plug and go' retrofit package, allowing the removal of the old control and its replacement by a new control cabinet, with the machine's old connectors being reattached within the new cabinet. The retrofit whose pictures are in this article took just six working days. That time included replacing two ball screws, a quill and a new spindle drive, in addition to replacing the control.

If you need more information about the P&W retrofit kit please contact **MACHINEMATE** Inc using any one of the methods (phone, fax, email) listed at the end of this article.

Mark Rice has accumulated experience in all facets of the machine tool industry. Mark has worked with machine tools from a number of vendors as well as many CNC controls and several PC motion control cards. **MACHINEMATE** Inc supplies a family of premier PC-based CNC products. The use of Windows NT, a standard Pentium motherboard, standard PC components, an IEC-1131-3 conformant integrated soft PLC, the capability of Ethernet and standard field bus systems and the support for either analog or SERCOS drives give this CNC package the utmost flexibility and openness available today.

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