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PMAC Software Installation Procedure

Introduction

Scope

This document describes the procedure for installing software onto the Programmable Multi-Axis Controller (PMAC) servo control system. These instructions are intended to be applicable to any project in which a PMAC is used.

The PMAC, built by Delta Tau, is used to control servo motors and other electronic devices in various projects undertaken by EOST. PMAC boards are often at the heart of the Telescope Control Cabinets of EOST observatory systems and provide control of devices such as the telescope and dome.

The installation procedure involved using the **PEWin** application to download software onto the PMAC. The procedure may also require first compiling the source code for the software.

This document does not describe how to install the **PEWin** application onto a computer. Please refer to separate documentation provided with the **PEWin** application for instructions.

Warning

Installing the PMAC software is a process that requires due care and experience. It should only be undertaken by experienced users who can recover the system if any errors occur during the installation. In addition to encountering errors during the installation process there may be bugs in the new version, it may not be set up correctly for the current hardware on the project, or it may not be compatible with the high level software to which it interfaces. Any of these problems can cause the system to fail and in some cases may lead to damage. Even if damage does not occur failures are not always obvious and can lead to expensive delays while problems are identified and fixed.

To minimise the risk of damage to equipment or costly delays:

- Confirm that the software which is to be loaded is the correct version.
- Confirm that it has been configured correctly for the project hardware.
- Consider dependencies and interactions with other system software.
- Follow the installation instructions precisely.
- Ensure that any other tasks related to installation of the new software, such as changing configuration parameters in other files or installing new versions of other applications, are carried out.
- Be especially vigilant for unusual behaviour when running the system with the new software.
- Have a recovery plan ready to restore the original software if the new version cannot be made to work.

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Requirements

The following components are required for this procedure:

- *An operating PMAC.*
  The PMAC must be powered on. It does not have to be connected to any controllable hardware during the installation phase, only if testing is required.

  In this document the term “PMAC” generally refers to the PMAC card plus any additional Accessory-24 axis extension cards attached to it. The PMAC may be either a PC-based model that uses the EISA or PCI bus, or the PMAC-VME model which conforms to the VME backplane standard. While these instructions are written for the Turbo PMAC, they may also be suitable for other versions of PMAC.

- *A PC.*
  An IBM-compatible personal computer (PC) running windows NT or another recent Windows operating system must be used to compile and install the PMAC software. This computer must have the **PEWin** program installed. The **PMACPlot** program is not necessary for installation. Note that it is not necessary for the PMAC to be installed in this PC.

- *A communications path from the PC to the PMAC.*
  If the PMAC is installed in the PC, then the PC should be able to communicate with the PMAC via the EISA or PCI bus (whichever format the PMAC card uses). Otherwise, a serial cable must be connected from the PC to the PMAC, and the **PEWin** software should be set up appropriately.

- *PMAC Software.*
  The correct version of the PMAC software to be installed must be available as a file or files on the PC. Typically this software is provided as a single downloadable file called `ALLFILES.PMC`, or as a set of three files that includes the source code, the downloadable file, and a script file for compiling the source code.

- *Experience with using the PMAC in the project.*
  The use should be familiar with controlling the PMAC through the low-level **PEWin** program. The user should also be familiar with the architecture and design of the project system including the arrangement of components and the operating principles of the software.

- *VI Software (only if compilation of the source code is required).*
  The **Elvis** implementation of the UNIX editor **VI** must be installed on the PC if the source code is to be compiled as part of the installation process. This software can be found on the Internet and is also available from EOST.

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Procedure

Overview

As supplied by the vendor the PMAC contains no special software, so it will be necessary to install an initial version of the software for the project. New versions of the software may subsequently be released to fix faults, add new functions, or change configuration parameters. In all of these cases the PMAC software must be built and loaded onto the PMAC.

This section describes the steps necessary to load the PMAC with a complete set of the routines (PLCs) it needs in order to operate. If a new version of the PMAC software is being installed, there may be additional instructions specific to the new version that will have to be followed.

The process is divided into two stages: compilation and installation. Compilation, which is not necessary if a downloadable version of the software has been provided, consists of building a downloadable file containing instructions that the PMAC understands from a source code file written in a language easier for humans to understand. Installation involved transmitting this file to the PMAC for storage in its non-volatile memory.

Files

The PMAC software is typically supplied as a set of three files:

`ALLFILES.SRC`

This is the source code for the PMAC software. It is very similar to the downloadable code except that a symbolic naming scheme is used for the variables (such a `P<ErrorFlag>`) rather that the numerical naming style that the PMAC recognises (such as `P3206`). This makes it easier to read and modify.

The name “ALLFILES” is a throwback to the original version of the PMAC software developed for the Keystone system, which was delivered as a set of 26 separate files, each of which had to be loaded into the PMAC individually. To simplify this operation the files were combined into one file, called ALLFILES, which could be loaded in a single operation.

`MAPVARS.VI`

This is a **VI** (**Elvis**) script file that is used to compile the source code in `ALLFILES.SRC` to produce the downloadable file `ALLFILES.PMC`. It consists of a long series of instructions to map the symbolic variable names to numeric variables. It will create `the ALLFILES.PMC` file, to avoid overwriting `ALLFILES.SRC`. Comments at the top of the script file describe how to use it.

`ALLFILES.PMC`

This is the downloadable code for the PMAC software, containing commands that the PMAC can understand directly.

Note that depending on the circumstances the file names may be different, and one or more of these files may not be supplied.

Compiling the Software

This section describes the procedure for compiling the PMAC software source code to generate a downloadable file that can then be loaded onto the PMAC. If an up-to-date version of the downloadable PMAC code has been provided (typically in a file called `ALLFILES.PMC`) then no compilation is necessary and the user should proceed to the next section.

For this procedure the files `ALLFILES.SRC` and `MAPVARS.VI` (or their equivalents) are required, and `ALLFILES.PMC` (or its equivalent) will be generated.

1. *Back up the existing files.*
   Ensure that a backup copy of the existing PMAC software is available in case it becomes necessary to uninstall the new version and revert to the previous version. It may be advisable to keep several backups if a series of changes are being made.

2. *Copy the new files to the PC.*
   Create a suitable directory on the PC if one does not already exist and copy in the set of files representing the new version.

3. *Compile ALLFILES.SRC to create ALLFILES.PMC.*
   `ALLFILES.SRC` must be converted into a form which the PMAC can understand. This is done by running an editing script to do all the work.

   Open `MAPVARS.VI` using the **Elvis** (**VI**) text editor. The easiest way to do this is to open the directory in which the files have been placed using ***File Manager*** and choose `File>>Run…` Then type **VI** `MAPVARS.VI` into the dialog box and click OK.

   Alternatively, run ***Command Prompt*** from the Windows Start menu, change to the appropriate directory, and type `vi MAPVARS.VI`.

   `MAPVARS.VI` is an **Elvis** script file with a brief description at the top. Follow the instructions in this description. This will typically involve typing in a line of characters such as:

   ```
   1G}"zy}@z
   ```

   Note that the characters must be typed exactly as they appear, with the appropriate case and no additional spaces or keystrokes, and it is not necessary to press `<Enter>` at the end of the line. When the last character is typed a macro will start running to convert the `ALLFILES.SRC` file into `ALLFILES.PMC`. Note that any existing `ALLFILES.PMC` file will be overwritten.

The macros will take several minutes to complete (typically between 5 and 15 minutes depending on the computer speed). When it is finished (there is no more activity and the editor shows the tilde (~) characters running down the left side of the window with "MAPVARS.VI" on the bottom line), type the following command to quit **Elvis**:

```
:q<Enter>
```

If ALLFILES.SRC could not be found then the script will stop with a mostly blank screen with the tilde (~) characters running down the left side of the window and the words "Not found" at the bottom. If this happens quit **Elvis**, make sure that ALLFILES.SRC is in the current directory with MAPVARS.VI, and try again.

Note that if time is an issue or if the **Elvis** editor is not available, then this step can be skipped and an existing copy of ALLFILES.PMC can be edited directly with a plain text editor such as **Notepad** to make the appropriate changes. However this is only possible for minor changes such as updating a configuration value, and it is vital that the same changes be made to ALLFILES.SRC (also using a text editor such as **Notepad**) so that they aren't overwritten the next time the PMAC software is compiled.

Installing the Software

This section describes the procedure for installing the PMAC software onto the PMAC. If an up-to-date version of the downloadable PMAC code had not been provided (typically in a file called ALLFILES.PMC) then the source code (typically ALLFILES.SRC) will have to first be compiled using the procedure in the previous section.

For this procedure the downloadable file ALLFILES.PMC (or its equivalent) is required.

1. *Back up the existing ALLFILES.PMC file.*
   Ensure that a backup copy of the existing ALLFILES.PMC file is available in case it becomes necessary to uninstall the new version and revert to the previous version. It may be advisable to keep several backups if a series of changes are being made.

2. *Copy the new ALLFILES.PMC file to the PC.*
   Create a suitable directory on the PC if one does not already exist and copy in the ALLFILES.PMC file representing the new version.

3. *Shut down the high-level software.*
   The high-level software that interfaces to the PMAC software must not be running when the PMAC software is updated. Ensure that all the high level applications have been terminated. Use "Ctrl+d" in the PMAC Executive to disable all high level PLC programs.

4. *Run **PEWin**.*
   Start the **PEWin** application running on the PC and confirm that it has connected successfully to the PMAC. A black Terminal window should appear in which commands to the PMAC can be typed and responses will be displayed. Depending on the current configuration of **PEWin** there may also be a Position window or a Watch window providing additional feedback about the PMAC.

5. *Reset the PMAC.*
   In the Terminal window of **PEWin** type the following command:

   $$$***<Enter>

   This clears all existing software out of the PMAC and resets it to its factory default settings (no PLCs). This process may take up to 5 seconds.

   Note that an error message stating "`Timeout during bus read`" may appear, depending on the configuration of **PEWin**. This is quite normal and can be ignored.

6. *Download `ALLFILES.PMC` to the PMAC.*
   In **PEWin** choose File>>Download File… Locate the directory from Step 2, select the new `ALLFILES.PMC` file and click Open. Click OK on the next dialog that appears to start downloading the file.

   If the PMAC is installed in the PC and is connected using the EISA or PCI bus, the download process should take around 20 seconds. If communicating with the PMAC via a serial cable, the download process may take several minutes.

7. *Enable the software.*
   Once the software has finished downloading, and provided no errors occurred, type the following command to start it operating:

   ENABLE PLC01 <Enter>

   This will restart all the high level PLC programs and initialise the appropriate variables. The software must be running before it is saved to the PMAC's non-volatile memory, since the operating state of the software is also saved.

8. *Store the software in PMAC's non-volatile memory.*
   Type the following command to store the software to the PMAC's non-volatile EEPROM:

   SAVE<Enter>

   This process takes about 10 seconds.

9. *Restart **PEWin** a couple of times.*

When the PMAC is reset to its factory default settings (Step 5 above) this often causes a temporary problem with the driver software. The next time an application such as **PEWin** or the high-level software attempts to connect to the PMAC it will be rejected.

To clear this problem, shut down the **PEWin** application and then restart it. This will appear to hang for about a minute before reporting that it has been unable to open a connection to the PMAC. Shut down the **PEWin** application again and restart it again. This time it should successfully connect to the PMAC.

10. *Test the software.*
    Follow any additional instructions provided by the new software (such as updating the high-level software) and then test the system thoroughly to ensure no faults have been introduced.