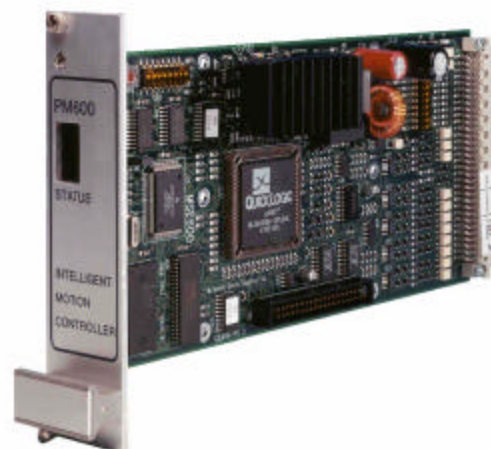


A fundamental feature of the Digiloop controller is the superior motion control algorithm developed to meet the most demanding accuracy requirements enabling unparalleled motor control to be obtained.

Low unit cost facilitates economic control

Unlike many other motion controllers the processor is used to control the motion of a single motor rather than being required to manage simultaneous motion of a multi-axis system. Since the controller only has one motion to supervise it is able to achieve much tighter loop control resulting in zero error. This, combined with the *digiloop* algorithm results in superior smoothness, stability and positional accuracy, even when remotely mounted high resolution encoding is employed. Where the sequential control of two axes is required however, a single *digiloop* may be used to control both motors. The compact size and low unit cost of *digiloop* ensures that even where the control of multi-axis systems is required the *digiloop* remains a space efficient and economic solution. In such systems the required number of controllers are simply linked together thereby providing the ultimate flexibility and maximum up-grade potential.



Major motion control features

- Analogue output to control servo motors using '*digiloop algorithm*' for increased accuracy.
- Digital output for use with stepper & digital servo drives
- Auto-tune and self optimisation of servo constants
- Digital control with maximum operating speeds $\geq 409,600$ counts/sec. for use with 6,000 rpm servo motors equipped high resolution encoder or resolver feedback.
- Maximum acceleration rate $\geq 20,480,000$ cps./s for 20msec. motor time constant
- Programmable base speed and independent creep/distance to target position
- Programmable 'S' curve acceleration
- Maximum positioning range $\pm 2,000$ Million counts
- Programmable application functions include:
- Stable positioning using direct monitoring of high resolution encoders equate to rotary resolutions and repeatability of 0.05 milli degrees or linear resolutions of 0.1 μm .
- Alternative constant velocity operation
- Electronic gearbox
- Electronic cam
- Flying shears
- $1\frac{1}{2}$ axis to control 2 servo axes sequentially.

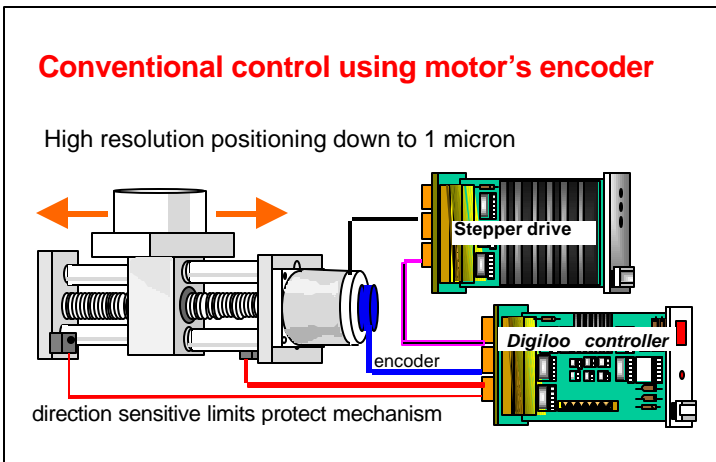
Programmable I/O

- User definable programmable optically isolated 16 digital I/O
- Analogue I/O for use with load cells, temperature and volumetric transducers etc.
- Manual jog inputs with programmable jog, slow and fast rate control and optional joystick interface
- Direction sensitive limits
- Datum inputs for accurate zero positioning
- Emergency stop input

Communication & Programming

- Multi Axis communication
- Choice of: RS232 daisy chain or RS485 multi-drop link
- Optional local display panel of position or speed
- Simple control language needs no additional software
- Standard screen editor for developing motion programme
- Multi-sequence capability for off-line operation

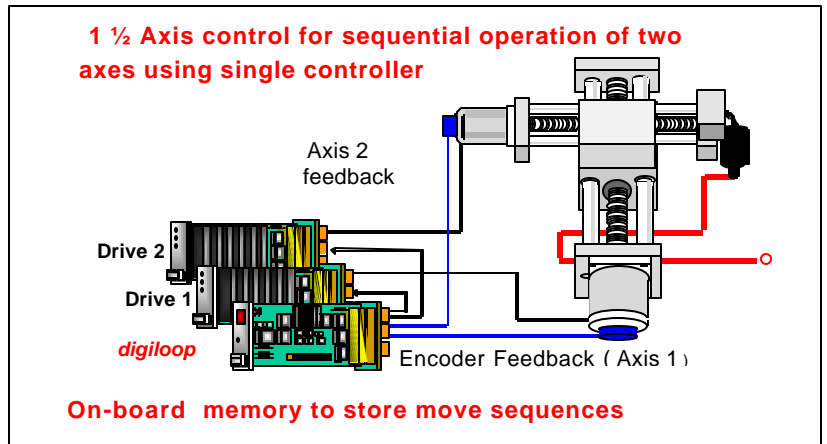
High accuracy positioning



The Digiloo controller is an ideal high accuracy positioner for use with modern servo systems. It enables very high accuracy combined with fast response to be obtained. Standard features include datum signal inputs and directional sensitive limits to protect the driven mechanism against an over-travel condition. Software limits are also provided to eliminate possible programming errors.

Single controller for dual axis-sequential control

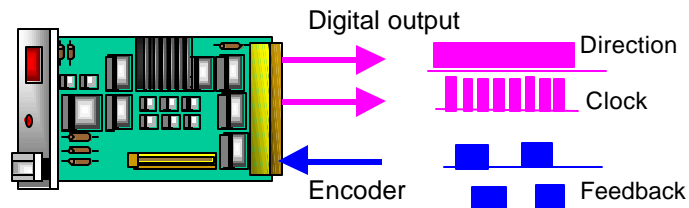
In applications where sequential control is sufficient, *digiloo* may be used to control two motors. Although, when using a servo motor a tachogenerator is preferred for maximum dynamic performance a motor equipped with just an encoder is in practice sufficient for most applications:



Choice of output signals

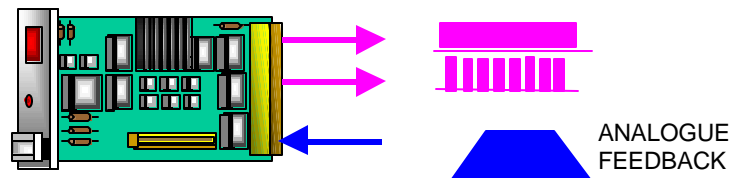
PM600 provides as digital output for use with stepper or digital servo drives. In this mode encoder feedback is optional depending on whether an open or closed loop system is required.

It will be noted that the PM600 monitors the leading and trailing edge of each encoder pulse to provide a x4 multiplication of each pulse cycle. Therefore by using a 500 ppr encoder a resolution of 2000 steps/rev is obtained.



In applications that utilise an analogue feedback transducer such as an LVDT this can be connected to an analogue input port of the PM600, configured to provide either analogue or digital output control signals

Other analogue feedback devices that can be employed include load cells and volumetric transducers.



PM600 digiloop controller

motion sequences

A number of sequences may be pre-programmed to enable repetitive movement cycles to be memorised within the *digiloop* controller. These sequences can include responses which are conditional to input line status as well as sending signals to the controller's output lines.

The desired response to signals received on the input lines may be programmed by the *digiloop* user in a variety of ways. Conditional responses include:

wait commands used to make the execution of the next step in the programme conditional on an input line state. This command may also be used to switch on an output line on completion of a movement.

'skip next' commands are used to jump a line in the sequence if a given combination of input signals is detected. Since a sequence may contain other sub-sequences the *digiloop* user may arrange a master sequence that enables input lines to be used to initiate a number of routines such as a start-up cycle on power-on.

digital I / O

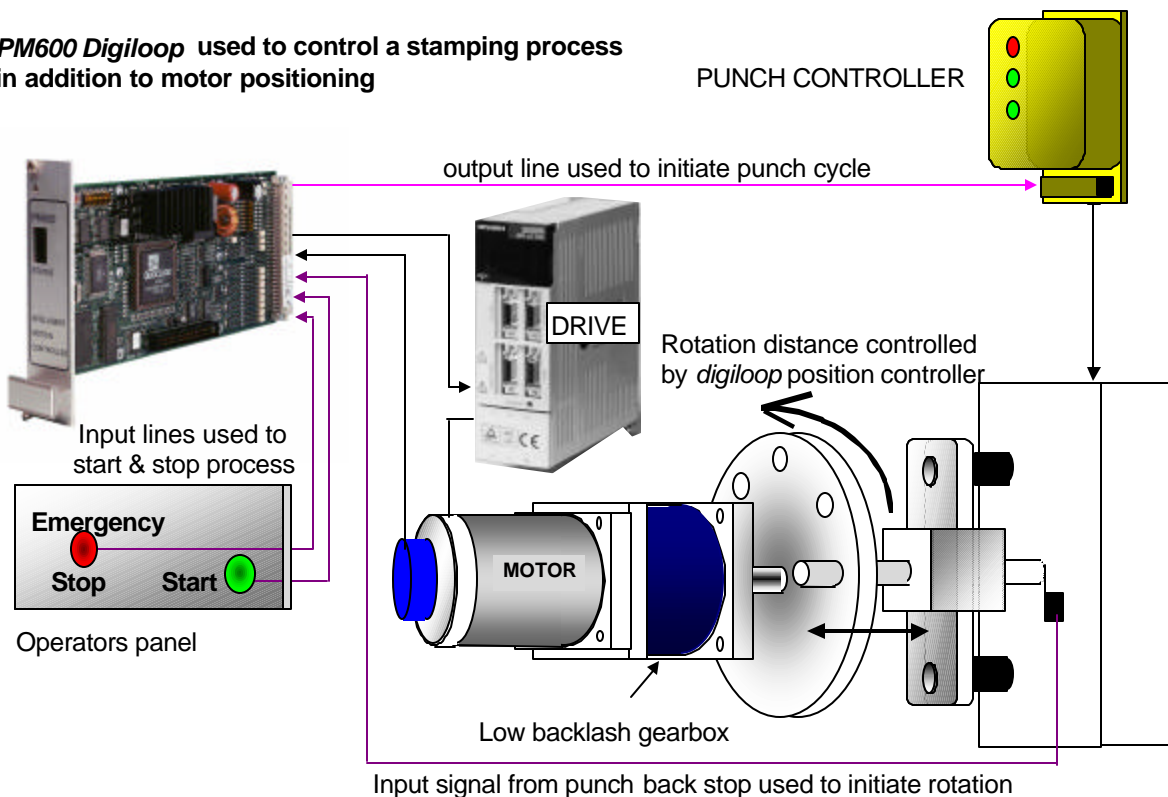
Each controller is provided with 8 optically isolated output and 8 input lines which may be programmed by the user to enable the *digiloop 2000* to be integrated with other machine functions.

When used as part of a sequence these I/O may be used to control a variety of conditional responses depending on the state of the I/O signal lines. Since each controller is provided with a total of 16 I/O, the use of several controllers in a multi-axis system will result in a large number of I/O lines being available. For example, a six axis system requiring 3 axes of simultaneous motion will utilise three controllers when 24 output and 24 input lines will be available. In many cases therefore *digiloop 2000* will provide sufficient control so that a separate PLC will not be necessary.

Since these user-definable I/O lines are in addition to dedicated signal lines used for datum & limit inputs etc. total freedom is provided to employ them to monitor application specific process signals.

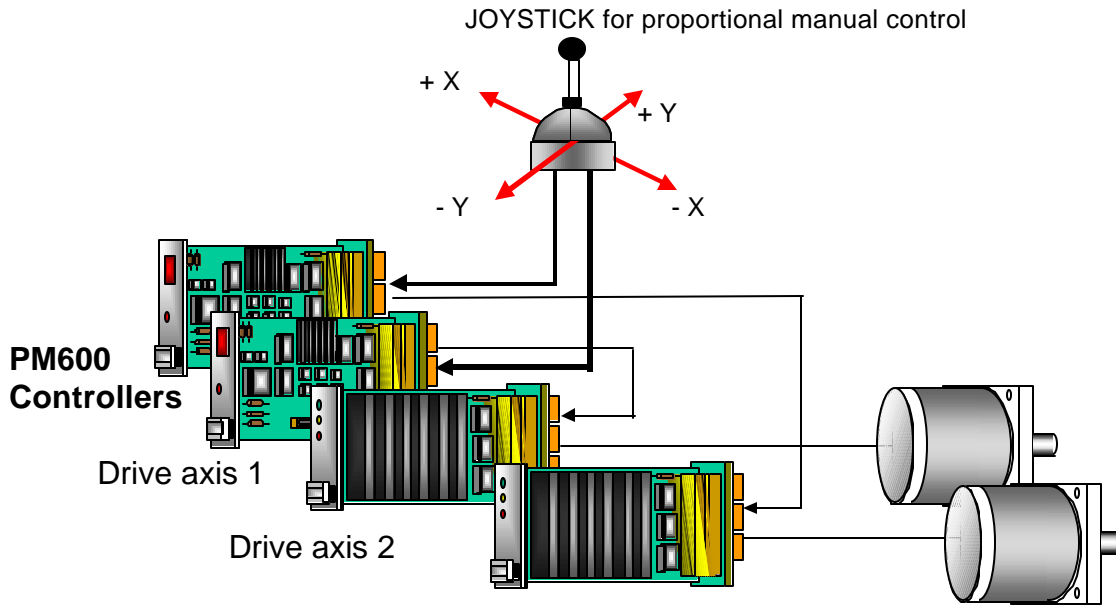
using digital I/O in a motion control sequence

PM600 Digiloop used to control a stamping process in addition to motor positioning



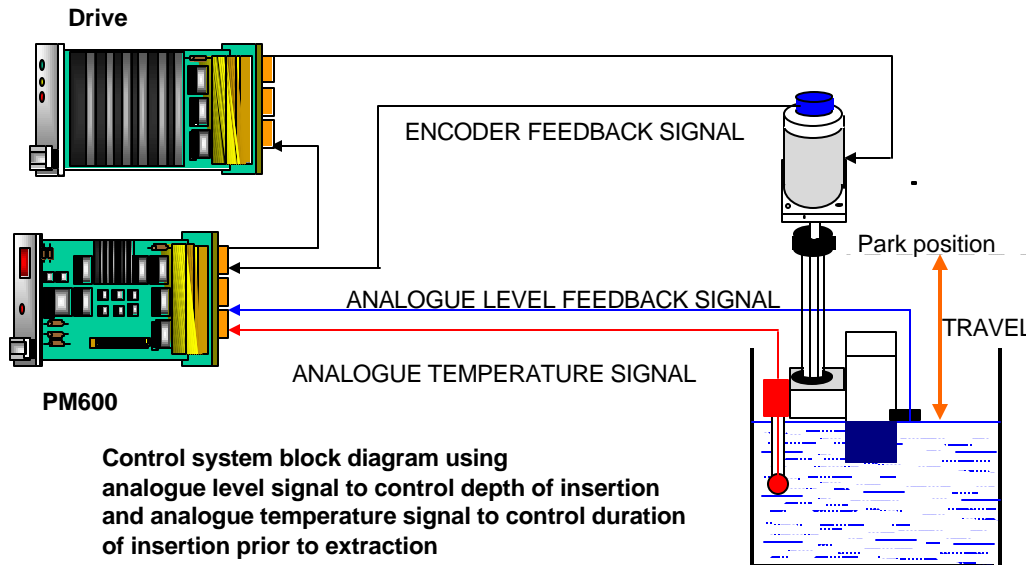
In addition to the optically isolated digital I/O, PM600 *digiloop* is provided with 4 programmable Bi-polar analogue inputs that will accept input signals up to $\pm 10V$. These may be further scaled to accept different signal levels, for example 0-5V, so that maximum resolution of the signal can be achieved. Examples of how the analogue inputs can be used are shown below:

using 2 analogue inputs for manual joystick control



using analogue inputs for process control

The analogue input signals may be used to control a manufacturing process. The monitoring of these signals can be combined with movement demands within a sequence for operation off-line from the host controller. As an example, the programmed insertion distance for a product to be dipped into a hot fluid can be controlled using an analogue level sensor to ensuring that the insertion depth remains constant. A second temperature sensor fitted to the product carrier could be used to instigate the retraction from the fluid once the desired product temperature has been reached.

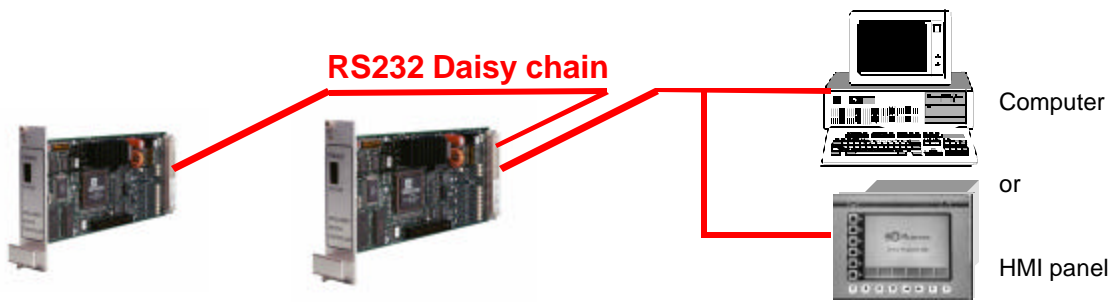


PM600 digiloop controller CHOICE OF COMMUNICATION

The PM600 *digiloop* controller is designed for use with a host computer or an HMI panel, communication in real time being via an RS232 daisy chain to provide multi-axis communication. Alternatively other interfaces may be specified such as RS485 may be specified. Up to 99 controllers can be interfaced using a single port

Communication via RS232 daisy chain

The RS232 daisy chain is a convenient means of communicating with the *digiloop 2000* when a PC is employed. Also, the increased availability of hand held and lap-top computers with an RS232 interface facility makes this an ideal means of communicating with up to 99 *digiloop* controlled axes.

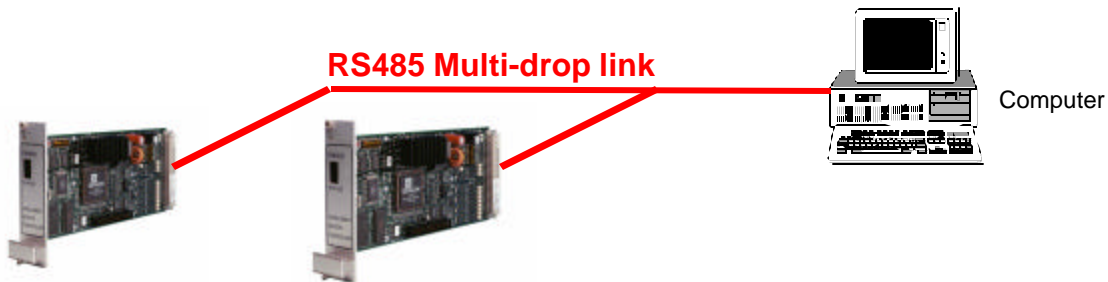


Alternative communication options

Digiloop controller options include an RS485 Multi-drop link which has a number of operating advantages in industrial control systems including:

- Differential signal line for improved noise immunity
- Parallel multi-drop communication up to 99 axes providing
- Improved system reliability
- Reduced communication time

RS485 interface



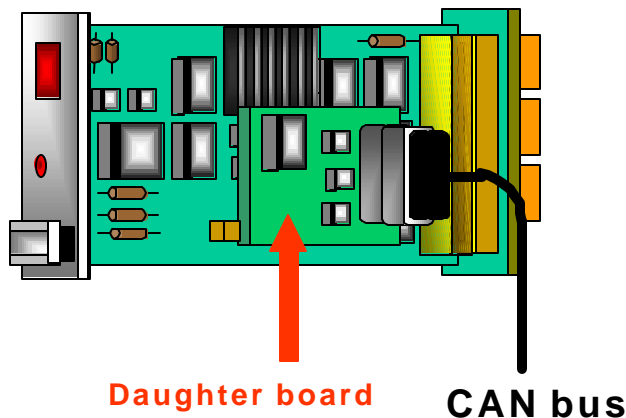
Daughter board option for

The PM600 is provided with an additional On-board connector into which a number of daughter boards may be fitted

This includes a CAN-bus interface module which enables the PM600 to be used in CAN based systems

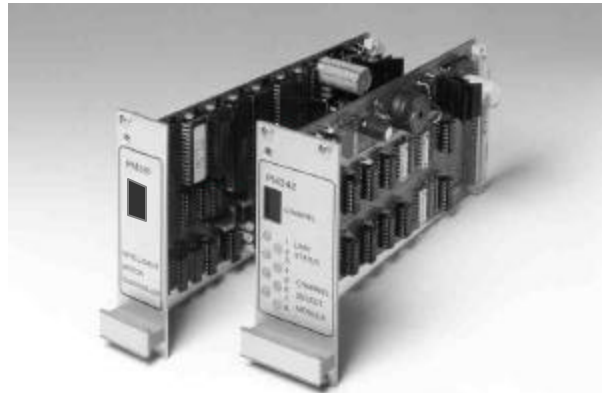
When using CAN based systems the PM600 can still be commissioned using an RS232 interface with, for example a Lap-top computer.

CAN-BUS interface



When used with motor systems which require digital control signals, the PM600 may be used in conjunction with the PM342 to provide multi-axis sequential control. Using this format up to 8 motor channels can be controlled from a single PM600 controller

PM600 Digiloop is provided with user friendly commands for selecting the desired motor and stores separate values of position, speed and acceleration etc., for each separate motor channel. Up to eight motor drives can be controlled from a single **PM600** based system from a single RS232 or RS485 port. Furthermore, in large multi-axis applications where a number of axes are also required, operating simultaneously, further PM600 controllers can be daisy chained on the same coms. port with **PM600/ PM342** units. In this way systems requiring very many axes of motion can be economically controlled. In scientific research applications for example, systems in excess of 64 axes are in use based on such combinations of controllers.



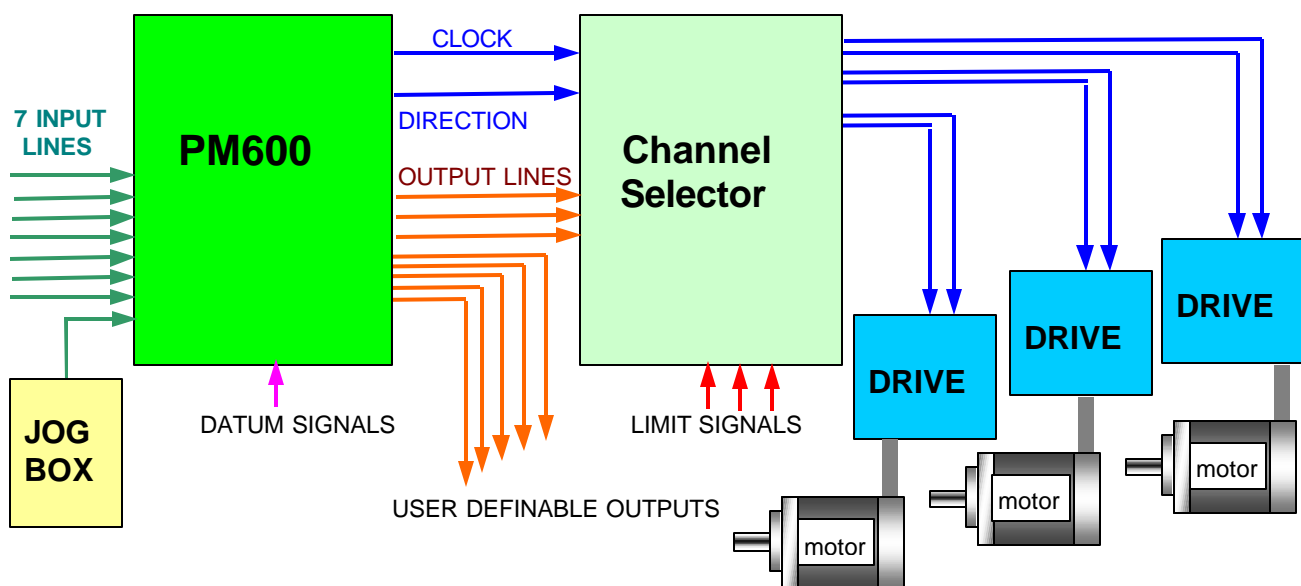
Operating principle

When the user selects a channel with a 'CH' command the **digiloop** PM600 uses three of its output lines to instruct the PM342 to direct the clock & direction signals to the desired motor drive unit, subsequent commands are therefore executed by the selected motor channel. The motion parameters for each separate motor channel are memorised and may be queried separately as part of the operational reporting function.

The **PM342 Channel Select Module** outputs the clock and direction signals derived from the **digiloop** PM600 for up to 8 motor drive channels. In addition, PM342 monitors the over-travel limits fitted to each axis to ensure that system protection is maintained. In the event of a limit conflict, further over-travel on the axis in question is prohibited. The PM342 provide a visual display of limit condition as well as the motor channel selected in addition to the normal on screen status reporting.

When manual operation is required the **JB800 jog box** enables up to 8 motor channels to be selected and manually driven by the standard jog button arrangement, independently programmable for each channel. The JB800 is also provided with a display showing the selected motor drive channel.

System block diagram for 3 channel control



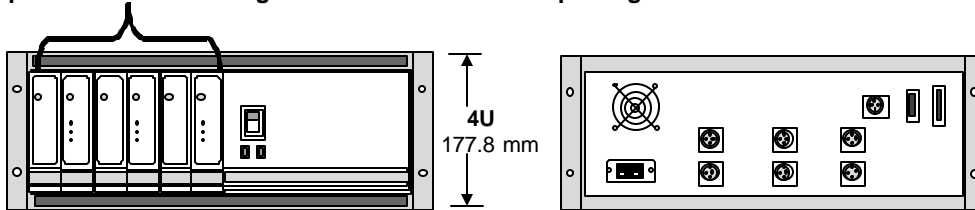
When manual operation is required the **JB800 jog box** enables up to 8 motor channels to be selected and manually driven by the standard jog button arrangement, independently programmable for each channel. The JB800 is also provided with a display showing the selected motor drive channel.

PM600 series system control packages are based on 'in-service proven' modular technology. The units may be purchased in modular form for integration in customer systems or as pre-wired crates prepared to meet current EMC legislation. Mclennan's modular philosophy provides flexibility and a wide range of customer choices.

Base on maximum crate density the following packages are available with integrated power supplies for direct connection to a single phase AC supply.

Stepper motor systems

Up to 3 drive axes using PM600 controller / drive packages



Where additional axis are required further crates may be interconnected Systems requiring up to 6 axis are supplied in 7U high Eurocrates.

Where additional axis are required further crates may be interconnected Systems requiring up to 4 axis are supplied in 7U high Eurocrates.