

PALS96 - User Manual Notes

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This document describes a number of different software aspects of the PALS unit compiled from a variety of sources particularly the Release Notes for each version. These are presented here in no particular order. The intention is that this text can be cut and pasted into the User Manual so there is only marginal formatting provided (no page breaks etc).

These notes apply to code version 2.0.

Programs

There are 4 distinct programs for the PALS unit:

- **Boot.** Resides in the PALS boot flash page. This always runs initially after powerup. It listens for the Host and, if not found, then starts up the Pals program. The Boot must always be blown into the flash before manufacture; this allows the Pals code to be blown into flash.
- **Pals.** Resides in PALS other flash pages. This is started by Boot if there is no host. This is the real operational code. After manufacture, there may be no Pals program.
- **Load.** Downloaded from Host by Boot program; allows a new Boot or Pals program to be blown into the flash.
- **Host.** A PC program which is used to load a new Pals program.

LEDs

There are two LEDs on the unit; A red DATA LED and a green BIST (built in self test) LED. These are used as follows:

		DATA	BIST
Boot program	power up	on	on
	receiving host data	flashing	on
	no host, no pals code	off	flashing
Load program	not receiving data	on/off	on
	receiving host data	flashing	on
	bad download	on/off	off
Pals program	fatal self test error	on	on
	not receiving data	off	off
	receiving dmx/mrl/host data	on	off

DMX Channel Assignment

The following table shows which DMX channels are used by PALS. This assumes that the DMX base address (Dmx\Adr menu) is set to 1.

For 16 bit DMX, Pan and Tilt each use 2 DMX channels from which they extract a 10 bit position. The first channel shown is the most significant and these 8 bits form the most significant bits of the 10 bit position. The second channel is the least significant; only the top 2 bits are used, forming the least significant bits of the 10 bit position.

8 bit position and velocity are converted internally to a 10 bits by using the 8 bit channel as the most significant bits of the 10 bit value. The least 2 significant bits of the value are copied from the most 2 significant bits; this ensures that the full 10 bit range (0 to 1023) can be covered.

	DMX8	DMX16
Pan	1	1, 2
Tilt	2	3, 4
Focus	3	5
Velocity (if enabled)	4	6

Display Operation

There are three types of display: Mode Display, Error Display and Menu Display. In addition, there is a Fault Display which can occur with any of these 3 displays. These are described below.

The user interface is implemented with 4 keys named MENU, SELECT, UP, DOWN and a 4 digit numeric display (each digit has 7 segments plus ‘.’).

Note that the display text described below will not necessarily appear as shown due to the limitations of displaying text on a 7 segment display. For example, ‘m’ is actually displayed as ‘n’.

Mode Display

After startup, the Mode Display is shown. This indicates one of the following depending on the Mode setting in the Menu Display:

- D.nnn DMX input where ‘nnn’ is the DMX address being used (0,1..512). DMX can be configured to be 8 or 16 bit, with or without a velocity control channel. The first two channels can be swapped with each other or inverted.
- M.nnn MRL input where ‘nnn’ is the MRL address being used (0,1..500).
- Sw.nn Switch mode where nn is the current preset being run. The RS485 input is used as a switch (hi/lo) to change between presets. The starting and ending preset can be configured and every time the switch is pressed on, it cycles to the next preset. The Switch can also be configured to switch to the first preset if off and the second if on. (Switch not yet working).
- There are 10 Presets, similar to a cue on a lighting desk. These are stored in non volatile memory (EEPROM). Each Preset consists of a 10 bit position and velocity for each channel.
- De.nn Demonstration mode where nn is the current preset (1..12) being run. The starting and ending preset can be configured. Every time the current preset ends (all motors stationary), it cycles to the next preset.
- Pr.nn Preset mode where nn is the current preset (1..12) being run.
- Stop Stop mode. This stops all the motors.

Pressing SELECT or MENU while in the Mode Display moves to the Menu Display. Pressing MENU

when at the top of the Menu Display moves back to the Mode Display.

If no key has been pressed for 10 minutes, the display automatically moves from the Menu Display back to the Mode Display. Any modification currently being made in the Menu Display is undone. If the Set\Disp\Auto is on (auto blank the display), the display is also blanked at the end of 10 minutes; pressing any key will unblank the display but otherwise ignore the key.

Menu Display

The Menu Display is entered from the Mode Display by pressing SELECT or MENU. Pressing MENU while at the first level of the Menu Display returns to the Mode Display. If no key has been pressed for 10 minutes, the display returns to the Mode Display.

The Menu Display is a hierarchy of menus with submenus as shown in the table below. This is navigated around using the keys.

After power up and first entering the Menu Display, this will show the bottom menu (Mode).

Error Display

If any errors occur during operation, these are put into an error log which holds the last 10 errors. The error log is saved into EEPROM and can be displayed and cleared by the Set\Err\Elog menu. If an error occurs which is already in the error log, the existing error is moved to the top of the log rather than logging duplicate errors.

When an error occurs, the Error Display appears. This displays a 4 digit number 'EE.LL' where 'EE' is the error code (1..99) and 'LL' is the error locus (0..99). The locus depends on the code, for example it is 1..3 for channel errors and 1..24 for an unexpected interrupt; generally it is 0. This also shows any debug errors which are detected.

While in the Error Display, the display flashes between high and low intensity once a second. Pressing any key will flag the error as 'seen' and the next error, if any, is displayed until the previous display (Mode or Menu) appears. Note that this does not clear the errors from the Error Log.

Fault Display

There are two types of Faults; System Faults and Channel Faults. These are displayed as errors but they also affect the system depending on the type of fault.

A System Fault occurs if a serious error is detected, such as memory or processor failure. The Error is displayed immediately and the system halts. This requires power cycling to reset it.

A Channel Fault occurs if an error is detected that only affects a particular channel. The error is logged as normal and the affected channel is flagged with the fault and disabled. The Fault Log (Set\Err\Flt menu) shows which of the channels has a fault (if any) and allows the fault to be cleared in which case the channel is re-enabled.

While there are any Channel Faults, all decimal points are flashed on and off. This allows Faults to be indicated regardless of the user display. If the faulty channels are disabled (Set\Ind\Dis# menu) then the decimal points are not flashed.

Faults are not saved in EEPROM so they are cleared by powering off or by resetting the unit (Diag\Rst menu). Faults can also be cleared by the Set\Err\Flt menu or by moving the velocity position to 0 (DMX).

Menu Structure

The Menu structure is shown in the table below. Note that this is shown with child menus *above* their parent. This reflects the way that the UP and DOWN keys scroll through the menu structure. This table has a number of columns:

Menu: This is the text for the menu as shown on the display. Indentation is used in the table to indicate submenus. There are three levels in the menu structure. A '#' at the end of the text indicates that this is replaced by the current channel number (1..3) which is always set by the 'Chan' menu below it. A '%' is replaced by the current Preset number (1..12) which is set by the 'Num' menu below it. The menu text always has a ' ' at the right hand side to indicate this is a menu.

Value: This can be one of the following:

'-'

Submenu

This menu has submenus (child menus). These are enumerated in the table above this menu. SELECT goes to the submenu. UP/DOWN moves to the next or previous menu at this level, MENU returns to the parent menu.

' value, value, ..'

Modifiable value

This indicates a modifiable value and its range. SELECT shows the current value (the Menu text disappears). This value can then be modified within its range using UP/DOWN. SELECT saves the value and returns to the menu; MENU undoes the value and returns to the menu. The Default column here shows the default value.

'(value, value, ..)'

Displayed value

This is a value which is displayed but cannot be modified. SELECT shows the value (this is updated about 4 times per second). Pressing SELECT or MENU returns to the menu. UP/DOWN are ignored.

'(BUSY)'

Execute procedure

SELECT executes the procedure (eg a test) and shows 'BUSY' on the display during this time (or a minimum of 0.5 second). After the procedure, it automatically returns to the menu. Any keys are ignored during execution.

'(CYCLE value...value)'

Execute procedure with input

This also executes a procedure but one which requires key input. The display shows the current value which can be changed using the UP/DOWN keys. SELECT or MENU (generally) returns to the menu.

'{..chan..}' is used instead of 'value, value, ..' to denote one of the channels 1..3 (Pan, Tilt, Focus).

'{..preset..}' is similar to '{..chan..}' above except that it denotes one of the presets (1..10). Each preset holds a set of positions and velocities for the channels.

'value...value' is a range; this is inclusive in steps of 1, eg '1..3'.

'..value..' is a range centred around the value.

'value-value' is a range which is non-contiguous, eg baud rate of '9k6-38k4'.

Default: This is shown for variable values which are stored in EEPROM; these are saved between power cycles. The defaults are set if the EEPROM checksum is bad (eg after manufacture) or the EEPROM structure version number is different than expected by the code (eg after downloading new code) or by the Diag\Ee\Clr (Clear EPROM) menu. Defaults marked with '*' may be different for each channel. Default values are fixed but may be changed when downloading the PALS code.

Usage: This gives a brief description of what the menu or variable is for.

Menu	(level 1..3)	Values	Default	Usage
Ee	Rst	(BUSY)	-	reset Pals and restart
	Chk	(BUSY)	-	check eeprom values
	Clr	(BUSY)	-	reset eeprom with defaults
	Volt	(BUSY)	-	Eeprom Facilities 5V & 24V
	Ram	(BUSY)	-	ram

	Flas	(BUSY)	-	flash page CRCs
	Moto	(BUSY)	-	motor outputs and inputs
	Eepr	(BUSY)	-	eeprom read/write
	Led	(BUSY)	-	toggle leds 5 times
	Uart	(BUSY)	-	uart loopback (RS485)
	Key	(CYCLE key)	-	show key press
Test	Disp	(CYCLE 1..32)	-	display segment, UP cycles segs, DOWN cycles intensity Tests
	24Hi	(..24..)	-	max voltage since powerup
	24Lo	(..24..)	-	min voltage since powerup
	24v	(..24..)	-	24v supply
	5Hi	(..5..)	-	max voltage since powerup
	5Lo	(..5..)	-	min voltage since powerup
	5v	(..5..)	-	5v supply
Volt		-		Monitor Voltages
	Pos#	(0..999)	-	MRL current position (moves towards Req over time)
	Req#	(0..999)	-	MRL required position (deferred or immediate)
	Nex#	(0..999)	-	MRL deferred next position
	Thi#	(0..999)	-	MRL deferred this position
	Pre#	(0..999)	-	MRL deferred previous position
	Jam#	(-ve,+ve)	-	position at start of timeout, -ve if jammed
	Mot#	(-2,-1,0..)	-	motor running (-2), disabled (-1) or timing out (0..)
	Chi#	(0..1023)	-	max/min motor current since startup
	CLo#	(0..1023)	-	
	Cur#	(0..1023)	-	actual motor current
	PHi#	(0..1023)	-	max/min pot position since startup
	PLo#	(0..1023)	-	
	Pa #	(0..1023)	-	actual (current) pot position
	Pd #	(0..1023)	-	desired pot position
	Out#	(0..±127)	-	PID output (to motor)
	Dif#	(0..±1023)	-	PID Dif (differential) term
	Sum#	(0..±1023)	-	PID Sum (integral) term
	Err#	(0..±1023)	-	PID Err (proportional) term
	Chan	{..chan..}	-	channel to monitor (#above)
Mon		-		Monitor Channels
	Tim#	1..254	*	max MRL time (secs), longer times limited to this
	Cur#	1..1023	*	cutoff motor current (fault if above this)
	Ran#	0..1023	*	operating pot range and min
	Min#	0..1023	*	(input position scaled between these to give Pd)
	Out#	0..127	*	max ± motor output (can be further limited by Input Vel)
	Jam#	1..99	*	motor jammed if Pa moved less than this after 10 sec
	End#	0..10	*	stop if Pa within this of Pd
	Acc#	1..127	*	max acceleration and triple max deceleration
	Lim#	0..1023	*	limit max Sum
	Dec#	1..256	*	+ve: Sum velocity decay
		-256..0		-ve: Sum fixed decay
	Kd #	0..256	*	PID algorithm constants
	Ki #	0..256	*	
	Kp #	0..256	*	
	Chan	{..chan..}	-	channel to configure (#above)
Conf		-		Configure Channels
	Tes#	(0..1023)	-	test channel calibration (SELECT/MENU to quit)
	Set#	(-50..0..50)	-	set channel calibration (UP/DOWN to adjust)
	Chan	{..chan..}	-	channel to calibrate (#above)
Cal		-		Calibrate Channels
Diag		-		Diagnostic Facilities (UP+DOWN then also SELECT)
	SCCS	(text)	-	source control version
	Time	(hour min sec)	-	time of code build
	Date	(day month year)	-	date of code build
	Info	(text)	-	manufacturer name and copyright
	PCF	(text)	-	name from Pals Configuration File (.PCF)
	Code	(text)	-	code version
Ver		-		version information (use UP/DOWN to scroll these)
	Auto	on, off	on	display auto blanks after 10 minutes
	Brig	low, med, high	med	display brightness
	Disp	-		setup display

	Flt	(CYCLE ..chan..)	-	show channel faults, SELECT clears
	Elog	(CYCLE 1..10)	-	show error log, SELECT clears all
Err		-		errors and faults
	PHi#	1023..0	1023	high position limit
	PLo#	0..1023	0	low position limit
	Dis#	on, off	off	disable the channel
	Chan	{..chan..}	-	channel to configure (#above)
Ind		-		Individual channel configure (except Man Mode)
	Bump	on, off	off	bumping position has no effect until pos/vel change
	Dej	0..4	0	dejitter lower n bits (DMX only)
	Swap	on, off	off	swap channels 1/2 (Pan/Tilt)
	Inv2	on, off	off	invert channel 2 (Tilt)
	Inv1	on, off	off	invert channel 1 (Pan)
Set	Gen	-		general channel configure (DMX/MRL Modes only)
		-		Setup Pals
	Pos#	0..1023	0	manually change channel position
Man	Chan	{..chan..}	-	channel to set position of (#above)
		-		Manual channel control
	V%#	0..1023	0	setup velocity
	P%#	0..1023	0	setup position
	Chan	{..chan..}	-	channel of preset to setup (#above)
Pres	Num	{..preset..}	-	preset to setup (% above)
		-		Presets
	Last	{..preset..}	1	last preset (last >= first)
Demo	Firs	{..preset..}	1	first preset (first <= last)
		-		Setup Demo mode
	Last	{..preset..}	1	last preset (last >= first)
	Firs	{..preset..}	1	first preset (first <= last)
Swit	Cyc	on, off	off	Cycle presets at switch on else switch off/on is first/next
		-		Setup Switch mode
	Baud	9.6..62.5	9.6	baud rate (in KBaud)
Mrl	Adr	0, 1..500	1	address
		-		Setup MRL mode
	D16	on, off	off	Dmx16 if on else Dmx8 if off
	Vel	on, off	on	use velocity channel if on
	Adr	1..512	1	address
Dmx		-		Setup DMX mode
Mode		Dmx, Mrl, Swit, Demo, Pres, Stop	Dmx	operating mode

Menu Description

Mode

This controls the input that controls the position of the luminaire. The UP/DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This can be set to the following values.

- Dmx The position and velocity input is taken from the external input which conforms to the DMX standard. The Dmx menu can be used to configure this input. The Set\Gen and Set\Ind menus also control its operation. The Mode Display shows D.nnn where nnn is the DMX address.
- Mrl The position and velocity input is taken from the external input which conforms to the MRL standard. The Mrl menu can be used to configure this input. The Set\Gen and Set\Ind menus also control its operation. The Mode Display shows M.nnn where nnn is the MRL address.
- Swit The position and velocity input is controlled by an on/off switch attached to the external input. The Swit menu is used to configure which Presets are used. The Set\Ind menu (but not Set\Gen) also controls its operation.

Demo	The position and velocity input cycle between the Presets configured in the Demo menu. The Set\Ind menu (but not Set\Gen) also controls its operation.
Pres	The position and velocity input are set by the Preset selected in the Pres menu. The Set\Ind menu (but not Set\Gen) also controls its operation.
Stop	The motors are all stopped although their positions can be changed in the Man menu.

Dmx

These submenus control the operation of the DMX input when the Mode is set to Dmx.

Dmx\Adr

This sets the DMX addresses that control the luminaire; this can range from 1 to 512. The UP/DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The number of DMX addresses actually used varies between 3 and 6 depending on whether velocity and 16 bit DMX (see below) are on or off. These addresses run contiguously from the base DMX address set here. For example, if Dmx\Vel and Dmx\D16 are both off and Dmx\Adr is 15 then addresses 15, 16, 17 are used to control the Pan, Tilt and Focus channels.

If in DMX Mode at the Mode Display (D.xxx displayed), pressing the UP and DOWN keys together then releasing them will go directly to this menu. The MENU or SELECT keys will then return to the Mode Display, saving any changes.

Dmx\Vel

This controls whether a DMX channel is used to control motor velocity and is either on or off. The UP/DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If set to off, a velocity channel is not used and all movements are at maximum velocity. If on, the velocity channel sets the maximum speed of the motors. A DMX value of 0 is maximum velocity and 255 is stopped.

This channel can also be used to clear any motor overcurrent faults by moving it to 255.

The velocity channel, if on, uses one additional 8 bit DMX channel contiguously after the Pan, Tilt and Focus channels.

Dmx\D16

This controls whether the Pan and Tilt positions are 8 or 16 bit and is either on or off. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If set to off they are 8 bit otherwise they are 16 bit. The Focus and Velocity (if used) channels are always 8 bit.

16 bit channels only actually use the most significant 10 bits; the least significant 6 bits are ignored.

Mrl

These submenus control the operation of the MRL input when the Mode is set to Mrl.

Mrl\Adr

This sets the MRL addresses that control the luminaire; this can range from 1 to 249. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If in MRL Mode at the Mode Display (M.xxx displayed), pressing the UP and DOWN keys together then releasing them will go directly to this menu. The MENU or SELECT keys will then return to the Mode Display, saving any changes.

Mrl\Baud

This sets the MRL baud rate and can be set to 9.6, 19.2, 38.4 or 62.5. These numbers are in Kbaud, for example, 9.6 is 9600 baud (9.6 Kbaud). The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Swit

These submenus control the operation of the Switch input when the Mode is set to Swi. The switch is used to run Presets.

Swit\Cyc

This controls how the switch uses the Presets and is either on or off. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If on, each time the switch is pressed on, the next Preset is run. After the last preset is run (Swit\Last menu) the first one is run (Swit\First menu). If set off, the first Preset is run if the switch is pressed off and the next one if the switch is pressed on.

Swit\First

This controls the first preset that the switch uses and can range from 1 to 10. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This cannot be set higher than the Preset set by Swit\Last.

Swit\Last

This controls the last preset that the switch uses and can range from 1 to 10. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This cannot be set lower than the Preset set by Swit\First.

Demo

These submenus control the operation of the Demo input when the Mode is set to Demo. Demo cycles between the Demo\First and Demo\Last Presets. It cycles to the next Preset when all the motors have stopped after the previous Preset.

Demo\First

This controls the first preset that the Demo uses and can range from 1 to 10. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This cannot be set higher than the Preset set by Demo\Last.

Demo\Last

This controls the last preset that the Demo uses and can range from 1 to 10. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This cannot be set lower than the Preset set by Demo\First.

Pres

These submenus control which Preset is run when the Mode is set to Pres and also is used to configure each of the Presets. Presets are also used by the Switch and Demo Modes.

To configure the Preset, change Pres\Num and Pres\Chan to the desired Preset and Channel then change the position in Pres\P%# and the velocity in Pres\V%#.

Pres\Num

This sets the Preset which is running in Preset Mode and sets the Preset to be setup. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It can be set from 1 to 10; the current Preset is substituted for the % symbol in the other Pres submenus.

If in Preset Mode at the Mode Display (P.xxx displayed), pressing the UP and DOWN keys together then releasing them will go directly to this menu. The MENU or SELECT keys will then return to the Mode Display, saving any changes.

Pres\Chan

This sets the Channel (motor) to be setup. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This can be set from 1 to 3; the current channel is substituted for the # symbol in the other Pres submenus.

Pres\P%#

This is the position of the Preset and Channel indicated by % and #. For example, P.05.3 is the position of Preset 5, Channel 3. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The position can be set from 0 to 1023 (minimum to maximum positions).

Pres\V%#

This is the velocity of the Preset and Channel indicated by % and #. For example, P.10.1 is the position of Preset 10, Channel 1. The UP and DOWN keys change it, SELECT saves the change and

exits, MENU discards the change and exits.

The velocity can be set from 0 to 1023 (maximum to minimum velocity).

Man

These submenus are used for manual control of the channel position. Manual control is only operative if the channel is disabled (Set\Ind\Dis# is on) or the Mode is set to Stop or there is no DMX/MRL input.

To manually control a channel, set Man\Chan to the desired Channel then change the position in Man\Pos#.

Man\Chan

This sets the Channel (motor) to be manually controlled. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It can be set from 1 to 3; the current channel is substituted for the # symbol in the other Man submenus.

Man\Pos#

This shows the current position of the Channel indicated by #. For example, Pos.2 is the position of Channel 2. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The position can be set from 0 to 1023 (minimum to maximum position).

Set

These submenus provide general and individual settings for the Channels together with Errors and Display settings.

Set\Gen

These submenus provide general settings for all Channels. These are only used when in DMX or MRL Modes.

Set\Gen\Inv1

This inverts Channel 1 (Pan) and is either on or off. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

When set to on, the position is inverted so that a maximum value moves to the minimum position and vv.

Set\Gen\Inv2

This inverts Channel 2 (Tilt) similarly to Inv1.

Set\Gen\Swap

This swaps Channels 1 and 2 and is either off or on. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

When on, the DMX/MRL input channels are swapped so that the first channel is Tilt and the second is Pan.

Set\Gen\Dej

This dejitters the DMX/MRL position and velocity inputs and can be set from 0 to 4. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

A value of 0 does no dejittering. A value of 1 to 4 forces the least significant 1 to 4 input bits to 0. Note that in 16 bit DMX mode, these actually affect bits 7 to 10 since only the most significant 10 bits are used (bits 1 to 6 are ignored).

Set\Gen\Bump

This controls the handling of bumps and is either off or on. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If set to on, after all the motors have got to their required positions and have switched off, any change in the luminaire position due to scenery bumps etc are ignored until a new position or velocity is input. If set off, any changes in the luminaire position is immediately corrected.

Set\Ind

These submenus provide individual settings for each Channel. These are used in all modes except Stop. Note in particular that these are not used when adjusting the position via the Man menu.

To set a channel, set Set\Ind\Chan to the desired Channel then change its setting in Set\Ind\Dis#, PLo# or PHi#.

Set\Ind\Chan

This sets the Channel (motor) to be set. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It can be set from 1 to 3; the current channel is substituted for the # symbol in the other Set\Ind submenus.

Set\Ind\Dis#

This disables the channel and is either off or on. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The channel is disabled if this is set to on otherwise the channel is enabled. If this channel has a fault, disabling it will also stop the decimal points from flashing.

Set\Ind\PLo#

This sets the lowest position that the motor will go to. The UP and DOWN keys change it, SELECT

saves the change and exits, MENU discards the change and exits.

Input positions below this will not cause any further movement. Note that this gives a deadband around the minimum position of the input. It cannot be set higher than Set\Ind\PHi#.

Set\Ind\PHi#

This sets the highest position that the motor will go to. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Input positions above this will not cause any further movement. Note that this gives a deadband around the maximum position of the input. It cannot be set lower than Set\Ind\PLo#.

Set\Err

These submenus provide access to the error log and channel faults.

Set\Err\ELog

This shows the last 10 errors. The UP and DOWN keys scroll through the errors. SELECT clears the whole error log and exits, MENU exits without clearing.

Errors are displayed in the format of EE.LL where EE is the error and LL is the locus. If there are no errors, a ---- is displayed.

Set\Err\ELog

This shows any faults for each channel. The UP and DOWN keys scroll through each of the 3 channels. SELECT clears the fault for the current channel and exits, MENU exits without clearing the fault. Faults are cleared at power-up or if the DMX velocity is taken to 0 or if a MRL Stop command is received.

Faults are displayed in the format of EE.LL where EE is the error and LL is the channel number (1 to 3). If there is no fault for a channel, 00.LL is displayed. Only the last fault for each channel is displayed. Channel faults also appear in the error log.

Set\Disp

These submenus control the display operation.

Set\Disp\Brig

This controls the display brightness and can be set to either low, med or high. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Set\Disp\Auto

This controls display auto blanking and is either off or on. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If set to on, the display will automatically blank 10 minutes after a key is pressed. It will unblank when any key is pressed.

Ver

These menus show The code version number and various other information. These are all text displays; use the UP and DOWN keys to scroll the text if it is longer than 4 characters.

Ver\Code

This shows the version number of the Pals software, for example ‘2.0’. For beta releases, the dot is replaced by a, b, c ... Note that this does not show the Boot software version. The SELECT and MENU keys exit; UP and DOWN are not used since the version number is never longer than 4 characters.

Ver\Pcf

If a PCF (PALS Configuration File) was used to change the default values during download, this shows the name specified in the PCF file. Otherwise it is blank. The SELECT and MENU keys exit; UP and DOWN scroll the text.

Ver\Info

This shows the name, manufacturer and copyright notice. The SELECT and MENU keys exit; UP and DOWN scroll the text.

Ver\Date

This shows the date that the code was built (day month year), for example ‘11 Apr 1997’. The SELECT and MENU keys exit; UP and DOWN scroll the text.

Ver\Time

This shows the time that the code was built (hours minute seconds), for example ’13:04:57’. The SELECT and MENU keys exit; UP and DOWN scroll the text.

Ver\Scs

This shows the SCCS (code source control) version that the code was built from, for example ‘2.1’. For beta releases, this displays ‘%W%. The SELECT and MENU keys exit; UP and DOWN scroll the text.

Diag

These submenus are intended for service and manufacturing use only. They are only displayed after the UP and DOWN keys are held down while the SELECT key is pressed.

Diag\Cal

These submenus are used to software calibrate the unit. Refer to the Calibration procedure.

To calibrate a channel, set Diag\Cal\Chan to the desired Channel then calibrate and test it using the other Diag\Cal submenus.

Diag\Cal\Chan

This sets the Channel (motor) to be calibrated. It can be set from 1 to 3; the current channel is substituted for the # symbol in the other Diag\Cal submenus.

Diag\Cal\Set#

This moves the motor to the calibration position. The position is then lined up exactly to the calibration position using the UP and DOWN keys. The display shows the offset (+/-50) from the default position. The offset may be limited to less than +/-50 if this is too close to the end stops. SELECT or MENU saves the calibration and exits.

This actually works by adjusting the operating minimum limit (Diag\Conf\Min# menu).

Diag\Cal\Tes#

This runs the calibration test and shows the current position of the pot. The SELECT or MENU keys exits the test. UP and DOWN are not used.

This test continuously cycles the motor between the minimum, centre and maximum positions at half speed.

Diag\Conf

These submenus are used to configure each channel.

To configure a channel, set Diag\Conf\Chan to the desired Channel then configure it using the other Diag\Conf submenus.

Diag\Conf\Chan

This sets the Channel (motor) to be configured. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It can be set from 1 to 3; the current channel is substituted for the # symbol in the other Diag\Conf submenus.

Diag\Conf\Kp#

This sets the position (Err) term constant in the PID motor control algorithm. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Diag\Conf\Ki#

This sets the integral (Sum) term constant in the PID motor control algorithm. The UP and DOWN

keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Diag\Conf\Kd#

This sets the differential (Dif) term constant in the PID motor control algorithm. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This is normally set to 0.

Diag\Conf\Dec#

This controls the decay of the integral term in the PID motor control algorithm. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If set greater than 1, the decay is proportional to the Dif (differential term) so that it decays faster as Dif gets larger. Low values of Dec decay faster than high values of Dec (at a given value of Dif).

If set to 0 or less, it decays at a fixed rate; low negative values decay fastest while high values decay slower.

Diag\Conf\Lim#

This limits the maximum value of the integral term in the PID motor control algorithm. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Low values mean that the integral cannot windup and cause instability.

Diag\Conf\Acc#

This controls the maximum acceleration and deceleration of the motor. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

Low values give low acceleration. The maximum deceleration is 3 times the maximum acceleration.

Diag\Conf\End#

This controls the end zone of the motor. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The end zone is the number of actual positions around the required position. For example, if the required position is 500 and the End was 2, the end zone is when the actual position is 500 or 501 (ie 2 stable positions). If End was 3, the end zone would be 499, 500, 501 (ie 3 positions).

When the actual position is within the end zone, the motor is stopped. The 3 sec motor timeout starts when the actual position is within the end zone plus 1 (ie 499, 500, 501, 502 if End is 2).

Diag\Conf\Jam#

This controls the amount of movement under which the motor is considered to be jammed. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If there is less movement than this over a 10sec period without a change in input position and the motor is not already switched off due to the 3sec motor timeout,, then the motor is switched off until

new input is received.

Diag\Conf\Out#

This controls the maximum motor output. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

This is generally set to its maximum.

Diag\Conf\Min#

This is the minimum operating position. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It is set during the calibration procedure. See also Ran# below.

Diag\Conf\Ran#

This is the operating range. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

The operating range is based at Diag\Cal\Min#. For example, if Min# is 100 and Ran# is 800, the operating positions are from 100 to 900.

The input position is scaled over the operating range. Using the above example, an input position of 0 scales to a required position of 100 and an input position of 1023 scales to a required position of 900.

Diag\Conf\Cur#

The overcurrent limit. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

If a motor exceeds this current, it is switched off and an overcurrent error is generated. The overcurrent fault is cleared when the velocity is set to minimum or the unit is power cycled.

Diag\Conf\Tim#

The maximum MRL time in seconds. The UP and DOWN keys change it, SELECT saves the change and exits,

An MRL command with a time which exceeds this value will execute the command for this channel using this time. It is generally set to the minimum time that the channel moves smoothly over its full range.

A value of 0 does not limit the time.

Note that this time is for a movement over its full range (from one end to the other). For smaller movements, Tim# is scaled accordingly. For example, if Tim# was set to 60 and a 50% movement was done, the time would only be limited if it was over 30 secs

Diag\Mon

These submenus are used to monitor the PID and other variables for each channel.

To monitor a channel, set Diag\Mon\Chan to the desired Channel then monitor the variables using the

other Diag\Mon submenus.

Diag\Mon\Chan

This sets the Channel (motor) to be monitored. The UP and DOWN keys change it, SELECT saves the change and exits, MENU discards the change and exits.

It can be set from 1 to 3; the current channel is substituted for the # symbol in the other Diag\Mon submenus.

Diag\Mon\Err#

This shows the value of the proportional (Err) term in the PID motor control algorithm. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Sum#

This shows the value of the integral (Sum) term in the PID motor control algorithm. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Err#

This shows the value of the differential (Dif) term in the PID motor control algorithm. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Out#

This shows the output from the PID algorithm to the motor. The SELECT and MENU keys exit. UP and DOWN are not used.

Diag\Mon\Pd#

This shows the required position. The SELECT and MENU keys exit; UP and DOWN are not used.

This is the input position (Man menu) after scaling by the operating minimum and range (Diag\Conf\Min#, Ran# menus).

Diag\Mon\Pa#

This shows the actual position as read from the motor potentiometer. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\PLo#

This shows the lowest value of Pa# since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\PHi#

This shows the highest value of Pa# since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Cur#

This shows the present motor current. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\CLo#

This shows the lowest value of Cur# since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\CHi#

This shows the highest value of Cur# since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Mot#

This shows the state of the motor timeout. The SELECT and MENU keys exit; UP and DOWN are not used.

A value of -2 indicates that the motor has not yet reached the end zone. A value of 0 or greater indicates that the end zone has been reached and the motor is in the 3sec timeout; this counts from 0 to 30 at the rate of 10 per sec. A value of -1 indicates that the timeout has expired and the motor is switched off.

Diag\Mon\Jam#

This shows the state of the motor jam detect. The SELECT and MENU keys exit; UP and DOWN are not used.

If positive, this is the position (from Diag\Mon\Pa# menu) at the start of the last 10sec period. A jam is detected if Pa# has moved less than Diag\Conf\Jam# at the end of this period and this value is set to a negative number which is the amount it actually moved. If a jam is detected, the motor is switched off until a new input position or velocity is received.

Note that setting a new input position with a velocity at minimum will cause jam detects because the motor never gets to its required position. This does not cause a problem however since jam detects do not generate an error and the motor is switched on when a new input is received.

Diag\Mon\Pre#

This is only used for MRL and shows the previous deferred position (0..999). This is copied from Thi# when a MRL ‘go’ command is received; it is copied into Req# when a MRL ‘back’ command is received. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Thi#

This is only used for MRL and shows the current (this) deferred position (0..999). This is copied from Nex# then copied into Req# when a MRL ‘go’ command is received. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Nex#

This is only used for MRL and shows the next deferred position (0..999). This is set when a MRL ‘deferred position’ command is received. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Req#

This is only used for MRL and shows the required end position of the channel (0..999). This is set on a MRL ‘immediate position’ command or copied from Thi# on a MRL ‘go’ command or copied from Pre# on a MRL ‘back’ command or copied from Pos# on a MRL ‘stop’ command. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Mon\Pos#

This is only used for MRL and shows the current position of the channel (0..999). This moves towards the Req# position over the time specified in the ‘g’ or ‘back’ command and is the position fed into the PID algorithm after scaling from MRL units of 0..999 to internal units of 0..1023.

Diag\Volt

These submenus are used to monitor the voltages.

Diag\Volt\5v

This shows the present 5 volt supply in 100’s of a volt. The SELECT and MENU keys exit; UP and DOWN are not used.

The nominal value is 500.

Diag\Volt\5Lo

This shows the lowest value of 5v since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Volt\5Hi

This shows the highest value of 5v since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Volt\24v

This shows the present 24 volt supply in 100's of a volt. The SELECT and MENU keys exit; UP and DOWN are not used.

The nominal value is 2400.

Diag\Volt\24Lo

This shows the lowest value of 24v since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Volt\24Hi

This shows the highest value of 24v since power up. The SELECT and MENU keys exit; UP and DOWN are not used.

Diag\Test

These submenus are used to run the onboard test facilities. Some of these tests are automatically run when the unit is powered up.

Diag\Test\Disp

This initially sets all segments on. Pressing the UP key cycles through each of the 32 segments in the display turning only that segment on before turning them all on again. Pressing the DOWN key cycles through the intensities. The SELECT and MENU keys exit.

Diag\Test\Key

This first checks that no keys are stuck down then displays Press. Pressing a key shows the pressed key for 0.5 secs before displaying Press again. Pressing MENU also exits the test.

If a stuck key is detected, this generates a STUCK error.

Diag\Test\Uart

This runs the tests for the UART device and then exits the test. No keys are used.

This can generate UFRAMING, UPARITY, URXNUM or URXBAD errors.

Diag\Test\Led

This turns the two LEDs on and off 5 times. No keys are used.

Diag\Test\Eepr

This runs the tests for the EEPROM non volatile memory device and then exits the test. No keys are used.

This can generate EEDEAD, EECRC or EEBAD errors.

Diag\Test\Moto

This runs the tests for the Motor drive circuitry and then exits the test. No keys are used. This test is also run at power up.

This can generate MOTPWM, MOTCUR or REVERSED errors.

Diag\Test\Flas

This checks the CRC checksum in each of the 8 pages of the Flash device used to store code then exits the test. No keys are used. This test is also run at power up.

This can generate the FLASH fatal error.

Diag\Test\Ram

This checks the RAM device then exits the test. No keys are used. This test is also run at power up.

This can generate the RAM fatal error.

Diag\Test\Volt

This checks that the 5v and 24v supplies are within tolerance. No keys are used. This test is also run at power up.

This can generate the VLO or VHI errors.

Diag\Ee

These submenus are used to clear or check the EEPROM non volatile memory contents.

Diag\Ee\Clr

This clears the EEPROM and sets all the variables back to their factory defaults.

Diag\Ee\Chk

This checks that all the variables in the EEPROM are within their allowed range. If not, an ERRCHECK or MENUCHECK error is generated and the EEPROM is set with factory defaults.

Diag\Rst

This resets the unit the same as if it was power cycled.

Menu Notes

Any changed values are automatically saved into EEPROM when the SELECT key is pressed.

After displaying or modifying a value or running a test etc, the menu automatically moves to the next entry; this makes it easy to look at or modify several values etc (eg to run all tests, got to Diag\Test and just keep pressing SELECT).

The menu remembers the last submenu you have visited for each menu and automatically offers that the next time you enter that menu.

The UP and DOWN keys autorepeat if held down but MENU and SELECT do not.

Magic Keys

When in the Mode Display (eg d.001 displayed), pressing the UP and DOWN keys together then releasing them will go directly to the DMX or MRL address (depending on the current Mode) which can be changed using the UP or DOWN keys. Pressing the MENU or SELECT key returns to the Mode Display.

The Diag menu and its submenus are not normally displayed. To enable these, enter the Menu Display (you cannot be in the Mode Display) then hold down UP and DOWN keys together then press SELECT.

Error Display

The error codes and loci are shown below.

```
*****
debug errors  (01..09)  put into Error Log

    ERR_PARAM          /* 01 procedure parameter errors      (Locus=0,1..)
    ERR_CONSIS,        /* 02 consistency check errors       (Locus=0..)
    ERR_A2D,           /* 03 A2D already running at restart
    ERR_EESIZE,        /* 04 eeprom data too large for eeprom
    ERR_MRLFRAME,      /* 05 MRL bad frame                  (Locus=various)

*****
general errors (10..79)  put into Error Log

    ERR_EEDEAD         /* 10 eeprom dead
    ERR_EECRC,          /* 11 eeprom bad crc
    ERR_EEVER,          /* 12 eeprom data version different to expected
    ERR_DISPDEAD,       /* 13 display dead
    ERR_ERRCHECK,       /* 14 eeprom error log not valid
    ERR_MENUCHECK,      /* 15 eeprom variables out of range   (Locus=MenuDef index)

    ERR_UFRAMING,      /* 16 uart Rx framing
    ERR_UPARITY,        /* 17 uart Rx parity

    ERR_STUCK,          /* 18 (test) Key stuck                (Locus=A2DKeyState)
    ERR_VLO,            /* 19 (test) low voltage             (Locus=24/5 volts)
    ERR_VHI,            /* 20 (test) high voltage            (Locus=24/5 volts)
    ERR_URXNUM,         /* 21 (test) uart loopback rx bad count
    ERR_URXBAD,         /* 22 (test) uart loopback rx data bad
    ERR_EEBAD,          /* 23 (test) eeprom read data bad
    ERR_MOTJAM          /* 24 motor jammed                  (Locus=chan)

*****
system faults (70..79)  put into Error Log, system halted

    ERR_MAIN           /* 70 main() drop thru
    ERR_INT,            /* 71 unexpected Interrupt          (Locus=int1..24)
    ERR_RAM,            /* 72 (test) ram failure
    ERR_FLASH,          /* 73 (test) flash checksum bad     (Locus=page0..7)

*****
channel faults (80..89)  put into Error Log, set chan Fault with error

    ERR_CHAN,           /* 80 internal (debug) error       (Locus=chan)
    ERR_MOTPWM,         /* 81 (test) motor pwm failure     (Locus=chan)
    ERR_MOTCUR,         /* 82 (test) motor no current      (Locus=chan)
    ERR_REVERSED,       /* 83 pot or motor wiring reversed (Locus=chan)
    ERR_RANGE,          /* 84 pot outside legal range     (Locus=chan)
```

```
*****  
channel faults (90..99)    as above but cleared when Velocity=min  
  
ERR_OVERCUR,           /* 90 motor overcurrent          (Locus=chan)
```

Motor Timeouts and All That

Once a motor has approximately reached its required position, it is switched off 3 seconds later. This stops the motors from getting overheating. The motor is re-enabled when a new position is received.

If the motor jams or otherwise doesn't get to its required position, it is switched off until a new position or velocity is input.

If no DMX has been received for 1sec then the motors are switched off. This stops the unit going haywire if the DMX lead is unplugged since this occasionally corrupts the data. Note that MRL Mode is not protected in a similar manner since MRL commands are not continuously received.

If a motor overcurrent fault is detected, the motor is switched off until the Velocity control is moved to minimum. This allows the channel to be re-enabled remotely. Note however for DMX, that velocity control must be enabled (Set\Ind\Vel# menu). Of course, MRL always has Velocity.

If Bump is on (Set\Gen\Bump menu), after all motors are switched off, any change in the luminaire position due to scenery bumps etc are ignored and PALS does not try to restore itself to its required position until a new position or velocity is input.

Resetting Faults

If a motor overcurrent is detected, a fault is generated and this channel is disabled. The fault is cleared and the channel is re-enabled at power-up or if the DMX velocity is taken to 0 or a MRL Stop command is received.

Calibration

Mechanical Calibration

This setup may be done without the PCB installed. If the PCB is installed, power must not be applied to the unit before this setup is done.

The tools required for this are:

- Phillips screwdriver
- 1.5mm hex key
- 7/8" spanner
- ohm-meter

When following the procedure below, ensure that all pots are.

Pan Setup

- Ensure that the pot is locked tightly to its bracket.
- Release the Pan pot clamp and disengage the pot gear wheel
- Manually turn Pan anticlockwise (viewed from the top) to its mechanical limit

- Turn the pot anticlockwise (viewed from the top) to its limit
- Back pot off 4 teeth (ohm-meter reading of 250...350Ω) and clamp it
- Check that Pan moves freely fully to its opposite limit without binding or hitting the pot limit

Tilt Setup

- Ensure that the pot is locked tightly to its bracket.
- Release the Tilt pot clamp and disengage the pot gear wheel
- Turn Tilt upside down (Focus mechanism uppermost) to its mechanical limit
- Turn the pot anticlockwise (viewed from pot side) to its limit
- Hold the Tilt on its limit to take up slack
- Engage pot in first possible tooth (ohm-meter reading of 1...200Ω) and clamp it
- Check that Tilt moves freely to its opposite limit without binding or hitting the pot limit

Focus Setup

- Ensure that the pot is locked tightly to its bracket.
- Tilt the unit until it is pointing down
- Release the carriage clamp and pot grub screw
- With a spanner, move the capstan anticlockwise (viewed from pot end) until cable is at the end and approximately tangential to the capstan
- If necessary, back off the capstan clockwise up to S turn until the pot grub screw is accessible
- Remove pot with bracket and move the pot fully clockwise (viewed from pot spindle end) then back off j turn (ohm-meter reading of 650...850Ω), replace bracket and tighten grub screw
- Move carriage fully forward and tighten clamp
- Check that Focus moves freely to its opposite limit without binding or hitting the pot limit and check that there is still cable on the capstan (some units incorrectly have one less turn of cable)
- If there is no cable on the capstan at this point then repeat from the step 4 but turn the capstan anticlockwise very slightly (less than 1/8 turn) until the pot grub screw is accessible.

Software Calibration

The Mechanical Setup **must** first be done. Move all three functions well away from their mechanical limits (eg to center). The PCB needs to be installed and powered on. Go to the Diag\Cal menu as follows.

- Press the SELECT key to enter the menu structure
- Press and hold UP and DOWN together then also press SELECT to enable the Diag menus
- Press and hold UP until Diag is displayed and press SELECT
- Press DOWN until Cal is displayed and press SELECT

Pan Setup

- Press the DOWN key until Chan is displayed, press SELECT, change the channel number to 1 and press SELECT. Set1 will be displayed. Press SELECT. The current calibration offset (+/-50, default 0) will be displayed and Pan will move to its approximate center position.
- Adjust the Pan position using the UP/DOWN keys until the yoke is aligned parallel with the fixed

assembly above it then press SELECT or MENU

Tilt Setup

- Press the DOWN key until Chan is displayed, press SELECT, change the channel number to 2 and press SELECT. Set2 will be displayed. Press SELECT. The current calibration offset (+/-50, default 0) will be displayed and Tilt will move to its approximate center position.
- Adjust the Tilt position using the UP/DOWN keys until the lamp housing is aligned vertically with the yoke arm then press SELECT or MENU

Focus Setup

- Press the DOWN key until Chan is displayed, press SELECT, change the channel number to 3 and press SELECT. Set3 will be displayed. Press SELECT. The current calibration offset (+/-50, default 0) will be displayed and Focus will move to its approximate center position.
- Adjust the Focus position using the UP/DOWN keys until the gap between the carriage and the fixed end plate is about 8mm then press SELECT or MENU

Calibration Test

This should be done after the Software Calibration. Go to the Diag\Cal menu.

- Press the DOWN key until Chan is displayed, press SELECT, change the channel number to 1 and press SELECT. Press UP until Tes1 is displayed. Press SELECT. The current pot position will be displayed. Check that Pan repeatedly moves between its minimum, center and maximum positions. Press SELECT or MENU to stop.
- Repeat for channel 2 and check Tilt.
- Repeat for channel 3 and check Focus.

Downloading New PALS Code

This procedure outlines how to download new code to the PALS unit. This requires the HOST.EXE program and optionally one or more PCFs (PALS Configuration File).

Run the host program and follow the onscreen instructions.

After the download is complete, the PALS unit will generally come up with a flashing error 11.00 or 12.00 to indicate that the EEPROM defaults have been loaded. Press any key to clear the error.

If the EEPROM defaults were loaded (error 11.00 or 12.00 above), go through the Calibration Procedure. The Mechanical Calibration part of this can be skipped if it has previously been done.

If you are using the serial COM2, COM3 or COM4 port, run ‘host comX’ instead, where X is the port number, for example ‘host com2’. Com1 is the default and does not need to be explicitly entered.

The host program prompts for a PCF file to use if it finds any in the current directory. The PCF file is used to change the default PALS configuration during download. An example PALS configuration file (example.pcf) is provided. This should be copied to a new filename (but it must end in .PCF) then modified as necessary. These PCF files should be placed in the current directory when the host program is run (the current directory may be different from the directory where the host program resides). The host program allows one of these PCF files to be selected (maximum 10 PCFs).

A PCF file can instead be specified on the command line, eg ‘host myconfig.pcf’. A full pathname can be specified so the file can be anywhere, eg ‘host c:\pcf\myconfig.pcf’. If nul.pcf is specified, the

download is done without using or prompting for a PCF.

The host program can also be run in debug mode by ‘host debug’. This allows the user to issue low level commands to the PALS unit and is intended for development purposes only.