SPECTRACOM

Equipment Handbook

SPECTRACOM Type 2804A
GPS MASTER CLOCK

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Designed and manufactured in the U.K.

SPECTRACOM Type 2804A

EQUIPMENT HANDBOOK

Issue 5 October 2011

Configuration list

STANDARD-FIT ITEMS:

2 x Serial RS232 duplex control ports (Com Port 1 and 2)

6 x Reference Frequency outputs (Sine, +13dBm)

2 x Timing Pulse outputs, 1Hz/1pps, TTL

2 x Timecode outputs, user selectable (Timecode 1)

1 x Remote Display drive output (RS422 Date/Time message)

1 x 1pps TTL input (Time Interval Measurement etc)

1 x Alarm output (contact)

GPS L1 C/A receiver, 8-channel correlator (with battery support for Rx memory)

230V/115V rms a.c. power (switchable)

1 x dc input (+24V battery support) / use optional

1 x dc output (to Spectracom Autochangeover/Distribution Unit eg 1886) / use optional

OPTIONAL-FIT ITEMS.

The following list indicates optional (hardware) features that may be fitted to the 2804A.
This list of available options is complete at the time of issue of this Manual.
Options S, T, G, H, L, P are mutually exclusive with each other, only one from this group can be fitted.
The appropriate code letters are appended to the basic unit number to indicate the variant.
EXAMPLE: If a 2804A basic unit were fitted with a 5MHz, Rubidium-Atomic reference oscillator and also the standard Synthesiser option, it would be designated 2804AFRS.

CODE	DESCRIPTION	EXCLUDES
F	Reference frequency is 5MHz. (instead of standard 10MHz)	--
R	Rubidium-Atomic Reference oscillator (in place of standard Quartz).	--
C	2nd Timecode channel (Timecode 2 -- outputs J13, J14)	--
D	Timecode-1 outputs are SMPTE code (only)	--
J	Auxiliary (fx) TTL output (Integer division from Fref)	--
S	User-Settable Frequency Synthesiser (outputs J20, J21, J22, J23)	T, G, H, L, P
T	Telecomms Frequency Synthesiser (G703.10, E1 or T1, Ext Ref opt)	S, G, H, L, P
G	5 x (additional) sine outputs at Reference frequency.	S, T, H, L, P
H	5 x sine outputs at 5MHz (from a 10MHz Reference frequency)	S, T, G, L, P
L	High-Speed Parallel Data Interface	S, T, G, H, P
P	5 x (additional) 1Hz (UTC) Timing outputs	S, T, G, H, L,

CONTENTS

WEEE

The equipment described in this handbook is classed as Electrical or Electronic Equipment and should be disposed of at the end of its working life in a manner that minimises impact on the environment and is in accordance with any local regulations.

Within the EU, disposal should be in accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive (2003/108/EC) which has been put in place to encourage use of the best available recovery and recycling techniques to minimise impact on the environment and reduce landfill.

UK customers should contact Spectracom for disposal instructions. Customers in other EU countries should contact the importers for disposal instructions.

Spectracom is a registered member of a Producer Compliance Scheme

HAZARD LIST

1. HIGH VOLTAGE PRESENT IN EQUIPMENT -- Possibility of Electric Shock

Safety notes

1(a) Before connecting or operating the unit ensure that the supply voltage/s and frequency are within the limits specified for the equipment.

The rear-panel a.c. voltage-selector switch must be correctly set *before* applying a.c. power at J1

The voltage-selector switch should not be operated when the unit is powered

The voltage range with the selector switch in the position marked 115 or 120 is:
single phase a.c. 99V to 132V r.m.s.

The voltage range with the selector switch in the position marked 230 or 240 is:
single phase a.c. 198V to 264V r.m.s.

The supply frequency range in either case is: 47Hz to 63Hz

Before connecting any d.c. source at J2, ensure that the characteristics of the power source are adequate and that the cable is correctly wired to the connector.
The d.c. supply voltage range for Rubidium reference equipped units [R option] is +22V to +32V.
Standard [Quartz reference] units allow d.c. operation down to +19V input.
The d.c. supply voltage must be positive relative to the chassis of the unit; the negative power terminal is connected to the 0V and chassis.

Check that the correct value of ac fuse is fitted [as marked on the rear panel and defined in the specification section] and that the fuse is correctly tightened in its holder.

Check that (i) the power lead in use is of the correct type.
(ii) the green/yellow earth conductor in the power cable is connected to safety earth at the source (supply) end.
(iii) the power cable connector is engaged with its retainer clip at the rear of the unit, to prevent accidental partial disconnection.
The unit is fitted with a separate earthing stud at its rear panel.
If the unit is installed in a rack with other equipment, check that the earthing stud is connected to a local safety earth point in the rack, and that the rack system itself is also correctly earthed.

1(b) If a fuse should blow during normal operation, it should be replaced only once.
Disconnect the supply before replacing the fuse
Always use the correct value of fuse as marked on the rear panel, and defined in the specification pages of the handbook.
If a second fuse failure occurs, the unit should immediately be isolated from the its supply sources and the appropriate repair/service action scheduled.

1(c) If it is necessary to remove the unit from its rack mounting position, always ensure that its mains power supply is switched off at source, and the a.c. and d.c. power lead/s are removed, before commencing removal of the unit.

1(d) If it is necessary to gain access to the interior of a unit for any reason always ensure that the ac mains supply is disconnected before starting to remove any covers.
Also ensure that any (green/yellow) earth bonding wire that may be connected to the cover plate is undamaged, and that it is correctly connected on refitment of the cover.

SPECIFICATION

Timecode Generator Type 2804A

A.C. POWER SUPPLY	:	115V / 230V rms, (nominal) Switchable at rear panel. Single-phase only.
Power loading	:	60VA maxm.,30VA typical
Voltage range	:	99V to 132V with selector switch in 115 or 120 position. 198V to 264V rms with selector switch in 230 or 240 position.
Frequency range	:	47Hz to 63Hz.
a.c. fuse rating	:	For 115V nominal operation: 1A anti surge (T1A 250V), 20 x 5mm. For 230V nominal operation: 500mA anti surge (T500mA 250V), 20 x 5mm.
POWER CONNECTOR (a.c. input)	:	J1 3 pin IEC mains connector to CEE22 and BS4491
	:	Mating socket with 2 metre LSF cable supplied.
	:	Colour coding to UK standards, brown = Live blue = Neutral green/yellow = Earth
POWER CONNECTOR (d.c. input)	:	J2 7-way profDIN socket
Use optional	:	(See Drg. No. 3719-6345) Connect only to Spectracom Battery support unit or equivalent protected supply, using approved cable. Voltage range +22V to +32V d.c.

SIGNAL CONNECTORS

DATA INTERFACES

COM 1 PORT / RS232 duplex Control	:	J5 9-way 'D' socket
COM 2 PORT / RS232 duplex Control	:	J6 9-way 'D' socket
Remote Display Drive / RS422 output port	:	J27 BNO (mini-twinax) connector

SIGNAL INTERFACES

Reference Frequency Outputs	:	J7 to J12, BNC (50ohm) 10MHz, Sine, +13dBm
Timing Outputs	:	J17 Output A J18 Output B BNC (50ohm), TTL 1Hz (squarewave) or 1pps (10 microsec) User-select from Panel or Com Port. UTC-aligned, LE on-time.

SIGNAL CONNECTORS continued

SIGNAL INTERFACES "

Timecode Outputs	:	J15 (Output A) J16 (Output B), BNC, 50 ohm source Both connectors carry same code group User-selectable (from Panel or Com Port): Timecode (1) = IRIG-A, IRIG-B, XR3, 2137 Default: IRIG-B Internal link-configurable for Modulated or Unmodulated code types. Defaults: Output A & B = Modulated (B122)
1pps Input Event-logging (time-tag)		J29 BNC CMOS or TTL compliant (+2V threshold) >5kohm input impedance. Waveform insensitive.

ANCILLARY INTERFACES

Alarm (contact)		J19, BNC Shell insulated from chassis/ground Voltage-free contacts
GPS Antenna	:	J4, L1 signal input, 50ohm, N type socket. Connect only to an approved GPS Antenna. Connector carries +5V dc supply to Antenna-head LNA; do not short-circuit. Connect/Disconnect only with power off.

INDICATORS (front panel)

LEGEND		**COLOUR**	**MEANING** (when lit)
POWER AC	:	(green)	ac supply on
DC	:	(green)	dc supply on
ALARMS			
SYSTEM	:	(red)	Processor Watchdog fault
RESET			
DISPLAY		(red)	Display module fault
BIT		(red)	Fault (any) detected by BIT
STATUS			
GPS		(green)	GPS receiver doing Fixes
CONTROL		(green)	Oscillator Control operational

TEMPERATURE RANGE	Operating	:	0°C to + 50°C RH 90% (non-condensing)
	Storage	:	-40°C to +70°C
SIZE	Width	:	483mm
	Height	:	44mm
	Depth	:	350mm excluding rear panel connectors.
WEIGHT			4.0 kg approx / excluding external cables & connectors
FIXING POINTS		:	Standard rack fixing holes in front panel. Tapped holes in side members (See G.A. Dwg) NOTE: When rack-mounting the 2804 unit, provide adequate weight support by using side brackets, a full-width support shelf/tray or roll-out runners. DO NOT 'cantilever-mount' the unit from its front panel alone.
FINISH		:	Parchment White paint on front panel surface. (Semi-matt black, time-of-order option)
		:	Black legends and lettering. (Black panel / White legends -- time-of-order option)
		:	Alocrom 1000 conductive finish on all other surfaces.

TIMING AND FREQUENCY PERFORMANCE SUMMARY

2804A WITH HI-SPEC SC-QUARTZ REFERENCE (10MHz)

All performance figures apply following a continuously powered, 30-day, stabilisation period from initial switch-on, and assume continuous powering thereafter.

Internal Reference Oscillator performance / in stand-alone, *without GPS drift-correction*.

Frequency Drift (Ageing) rate, after 30 days in continuous service	<1 in 10E10 / day
Short term stability (AVar, 1sec)	1 in 10E12
Temperature coefficient 0 to +50°C	1 in 10E9 p-p
Temperature coefficient +25°C +/-10C° (typical)	±3 in 10E10

2804A GPS drift-corrected performance / at quasi-constant temperature in the range 26°C ± 10C°.

Frequency (10MHz)

Accuracy (24hr averaging)	5 in 10E11 (ref USNO)
Stability (typical distribution, 1000 sec avg. 95% probability)	±1 in 10E10
Standard Deviation	5 in 10E11

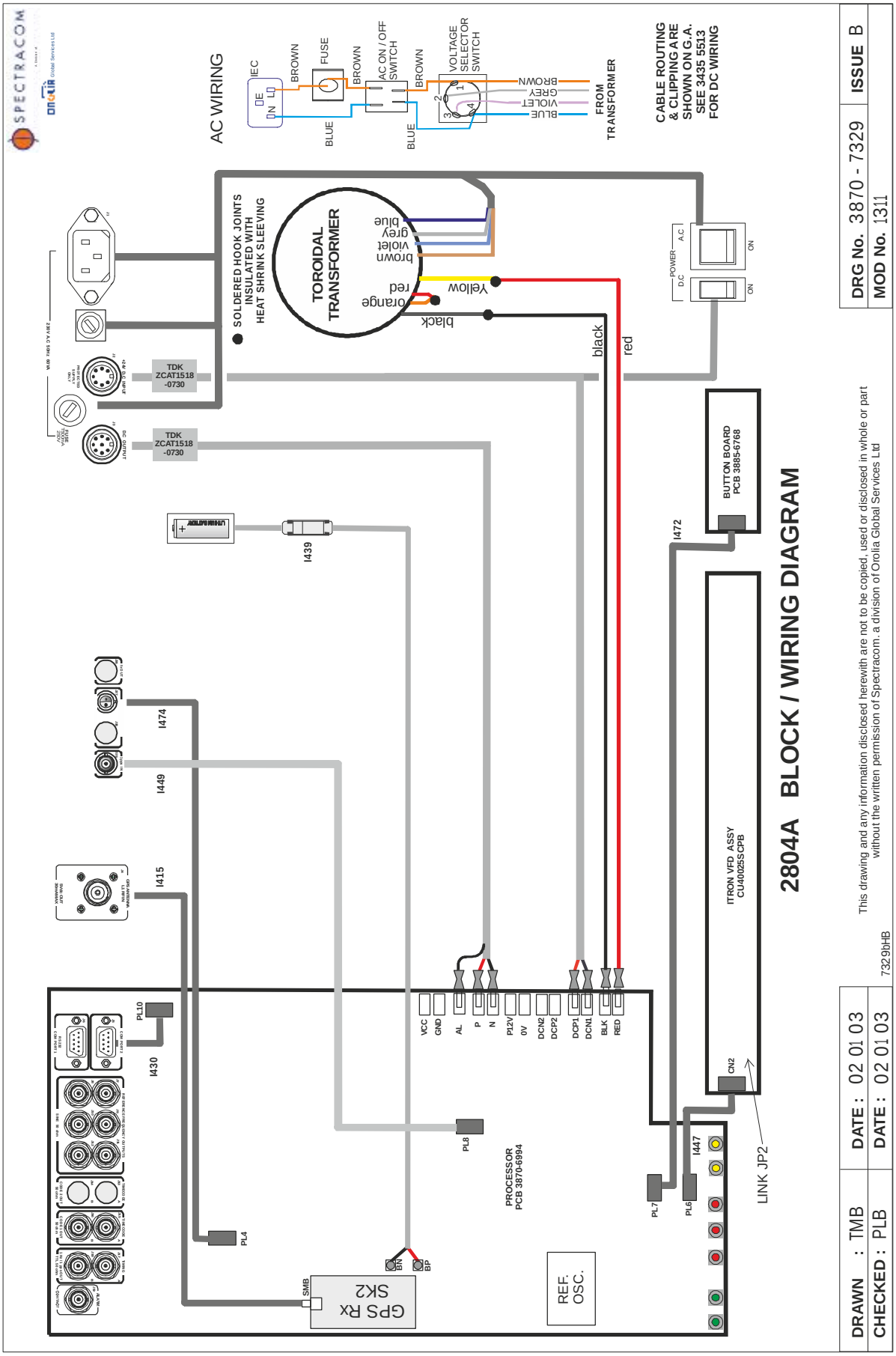
Timing (1Hz/pps)

Accuracy -- uncalibrated	±300 nanosec (ref UTC-GPS)
Stability (typical distribution, 95% probability)	±100 nanosec
Standard Deviation	50 nanosec

2804A (Quartz) Typical Stand alone Performance / operating without GPS, quasi-constant temp.

Frequency	Initial Error (ref USNO)	< 1 in 10E10
	Error at end of 8 hour period	< 1.5 in 10E10
Timing (1Hz)	Initial Error (ref UTC-USNO)	< 1 microsec
	Error at end of 8 hour period	< 4 microsec

Drg. No. 3870-7329 -- Block/Wiring Diagram Type 2804A



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Drg. No. 3719-6345 dc-support (input) connector--J2

W/O NO.	DRG.NO.
3719	6345
USED ON	

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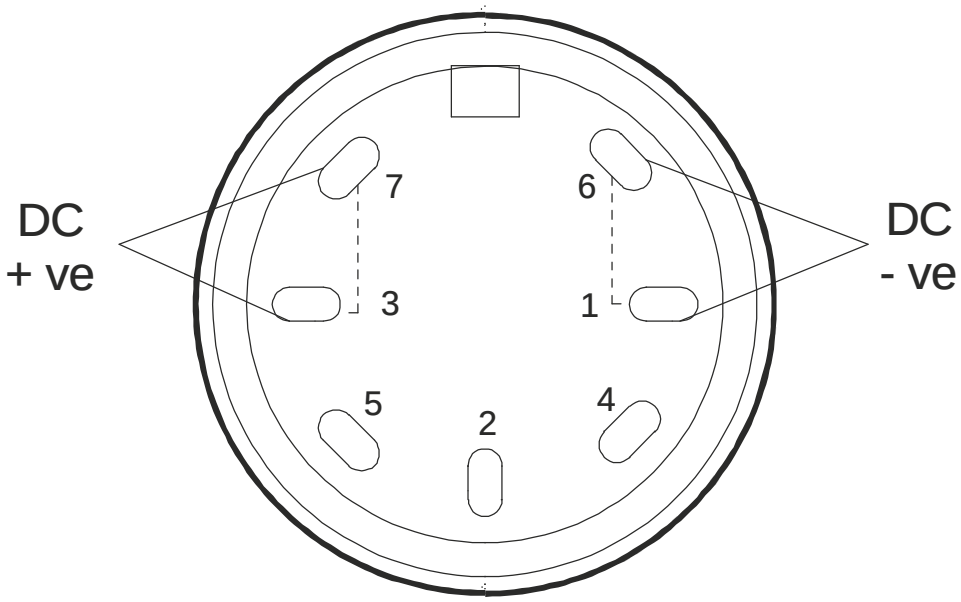
7 WAY DIN PROFESSIONAL SOCKET, FACE VIEW



CAD CORELDRAW 5

ISSUE	DATE	MOD NO.
359 A	22 05 98	X
B	19 06 09	1311

W/O NO.	3719		
FIRST ISSUE	DATE	TITLE	DC SUPPORT CONNECTOR
DRAWN DB	22 05 98		
CHECKED PLB	22 05 98	ORIG. SIZE A4	DWG NO 6345
		SCALE X	SHEET 1 OF 1

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Drg. No. 3719-6344 dc output/alarm-2 connector--J3

W/O NO.	DRG.NO.
3719	6344
USED ON	
1804X, 188X	

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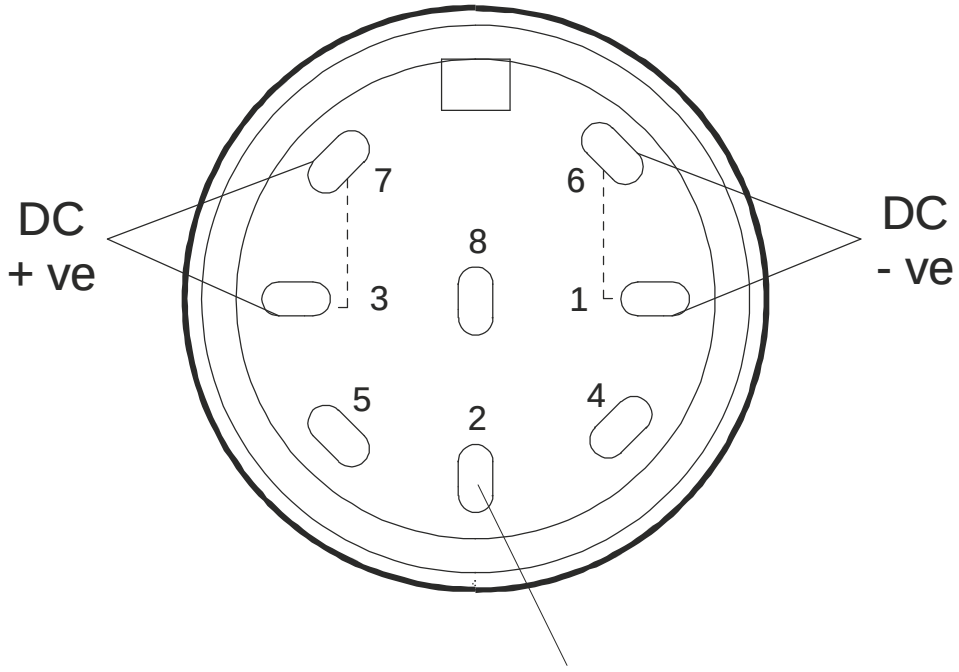
8 WAY DIN PROFESSIONAL SOCKET, FACE VIEW



CAD CORELDRAW 5

ISSUE	DATE	MOD NO.
359 A	22 05 98	X
B	19 06 09	1311

W/O NO. 3719		
FIRST ISSUE	DATE	TITLE: DC OUTPUT / ALARM 2 CONNECTOR
DRAWN DB	22 05 98	
CHECKED PLB	22 05 98	ORIG. SIZE A4 / DWG NO 6344
		SCALE X / SHEET 1 OF 1

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GENERAL DESCRIPTION

The 2804A is a GPS-referenced Master Clock providing a high level of Timing and Reference Frequency performance along with extensive functionality.
A large number of popular application-oriented features are standard-fit items, and there are a significant number of standard options.

The 2804 series incorporate many of the well tried features of the popular Spectracom 1804 range of units, and like the 1804 series are packaged in a 19inch rack-mount casing requiring a minimum of 1U (44mm approx.) of rack space.
The 'depth-into-rack, excluding connectors' dimension of a 2804 is greater than the 1804 by approximately 81 mm, (3.2 inch)

Primary power is normally drawn from a 230Vrms single-phase a.c. supply, with a rear-panel voltage-selector switch allowing the alternative of operation from 115V r.m.s.
A 50Hz or 60Hz nominal supply frequency can be accommodated without adjustment
Provision is also made for operation from a +24V nominal d.c. supply. This may be used in a power-support role, [eg from a Spectracom1811B6 Battery support unit] or as the unit's primary supply in mobile or temporary-rig operations.

The functional Block diagram is depicted in Drawing No 3870-7330 on the following page.

Two data interfaces are available for use between the 2804A and the user's system; these interfaces are RS232 Duplex ports, designated Com Port 1 and Com Port 2. The connectivity at these ports, and their functional details are described fully in later sections.
Use or non-use of the Com Ports is optional; since once initially configured, the unit will carry out all its primary functions without further support from the user.

Operational status and data are displayed in a high-readability alphanumeric display window, and a front-panel button array is fitted to allow manual control of settings and data entry.

All settable parameters may be entered either via the front panel buttons or by commands sent to either of the Com Ports (when the port is in Remote mode) The phrase 'Panel or Com Port' is used in this handbook when referring to this facility.
The unit has comprehensive built-in-test (BIT) facilities that include start-up tests, continual monitoring of power rails etc, and user-initiated interface and panel checks.

The Reference frequency signal is available at six independently-buffered connectors with high isolation performance, low harmonic and spurious content, and good Phase Noise (P-N) specifications.
Individual unit verification testing is available if required for P-N sensitive applications.

The 1Hz (UTC-aligned) Timing signal is available at two independently-buffered connectors and these signals can be user-configured (at Panel or Com Port) to provide either a 1Hz (squarewave) or 1pps (10 microsecond pulse) at either port.
In addition, the Timing signal can be configured either to stop when GPS lock is lost, or to continue in the stand-alone mode.

Additional standard features include Timecode generation, Event logging, Remote Time-display drive, Alarm output etc. These features are described in detail in following sections of this Manual.

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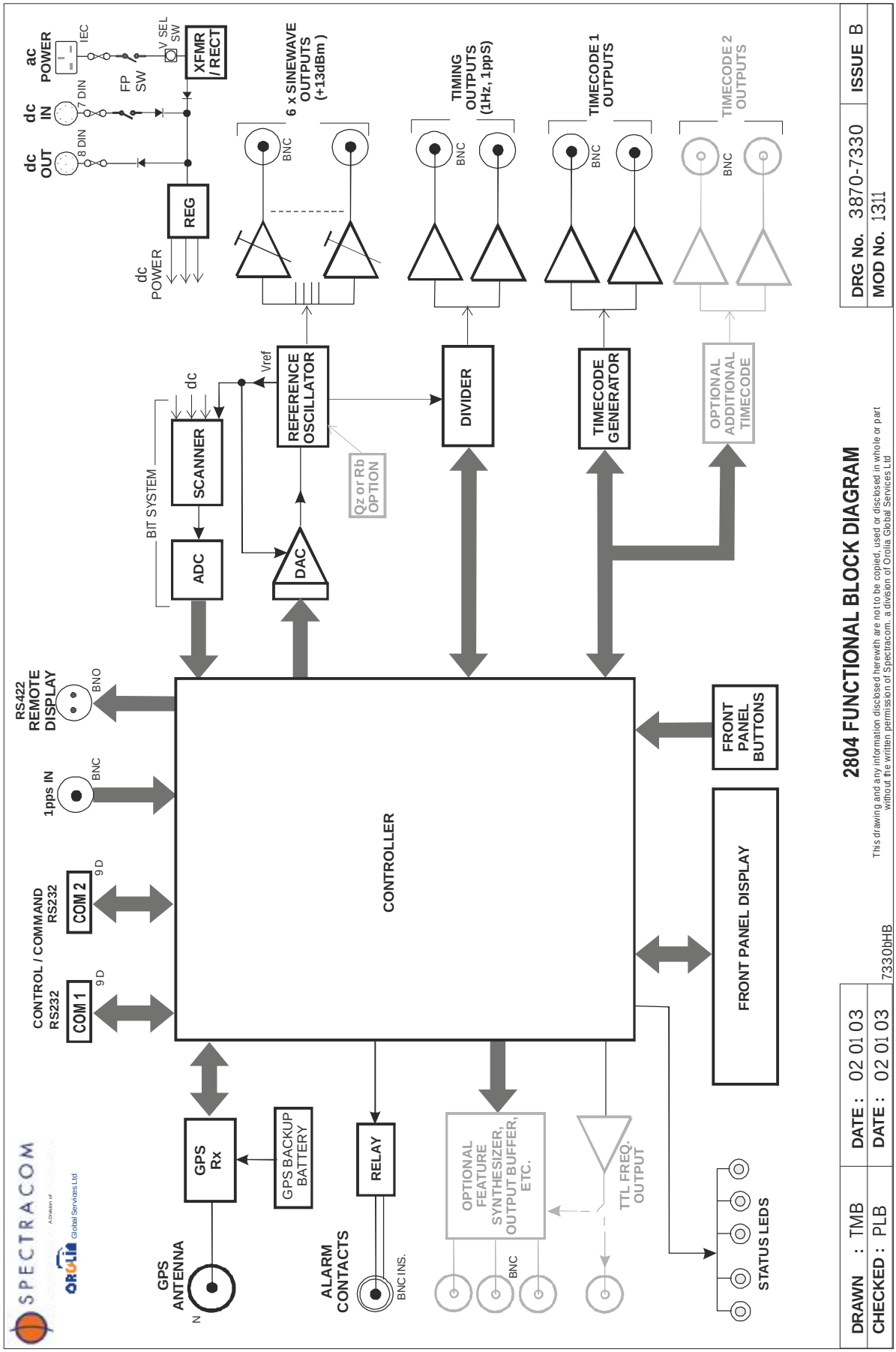
Drg. No. 3870-7330 -- Functional Block Diagram -- 2804A



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OPERATING INSTRUCTIONS

Connecting Power sources

The 2804A is intended for continuous powering from either 230V or 115V (nominal) 50Hz/60Hz ac supplies, according to the setting of the rear-panel a.c. voltage selector switch.
+24V (nominal) d.c. supplies may also be used, either as the primary power source, or as back-up.

THE REAR-PANEL VOLTAGE-SELECTOR SWITCH (ADJACENT TO THE J1 POWER CONNECTOR) MUST BE SET CORRECTLY FOR THE A.C. VOLTAGE IN USE

SEE SPECIFICATION, PAGE 1 <u>before</u> connecting power.

BEFORE CONNECTION, ENSURE THAT:

THE REAR-PANEL VOLTAGE-SELECTOR SWITCH IS SET CORRECTLY.
THE CORRECT FUSE IS INSTALLED.
THE AC SOURCE IS WITHIN THE SPECIFIED VOLTAGE RANGE.

THE AC CONNECTOR IS J1. THE CABLE SUPPLIED IS COLOUR-CODED TO UK STANDARDS.
ENSURE THAT THE GREEN/YELLOW CORE IS CONNECTED TO EARTH AT THE SOURCE.
THE AC ON/OFF SWITCH IS LOCATED AT THE RIGHT OF THE FRONT PANEL.

There is an earth stud on the rear-panel of the unit that should be connected to the rack safety earthing system when the unit is permanently installed in a rack alongside other equipment.
Supplies from external +24V (nominal) dc sources such as battery units may, optionally, be connected at the rear panel dc connector J2, either in a support role, or as the primary supply for mobile applications.

ENSURE THAT THE CHARACTERISTICS OF THE DC SOURCE ARE SUITABLE <u>BEFORE</u> CONNECTION. (see specification pages and notes below)

THE DC INPUT CONNECTOR IS J2, PIN CONNECTIONS ARE SHOWN IN DRG No 3719-6345.

THE DC ON/OFF SWITCH IS LOCATED AT THE RIGHT OF THE FRONT PANEL ADJACENT TO THE AC SWITCH.
<u>NOTE:</u> CONNECTION TO SOURCES HAVING INCORRECT VOLTAGE OR SOURCE IMPEDANCE MAY CAUSE DAMAGE TO THE UNIT.

NOTE: The dc supply source must be capable of handling a high inrush current when the supply is switched on; for this reason, stabilised ac/dc power units with 'fold-back' current limiting are often unsuitable. Trickle-charged battery supplies, or simple transformer/rectifier units with adequate smoothing are usually preferable. Fuse or thermal circuit-breaker protection is essential in either case.
The dc input interface is compatible with Spectracom Battery Support units such as the 1811B6, suitable cables are supplied with these units or are available as separate items from Spectracom.

Status following Power-up

<u>LED indicators</u>
When the a.c. supply is first established, the ac power indicator will be on.
The dc indicator will be 'on' only if a dc source has been connected.
Immediately after power-up, the front panel will display the Initial page; this will remain on during the Initialisation period. All the led indicators will illuminate briefly and also the Beeper will sound..
When Initialisation is complete, the unit will display the MODE page in the MAIN menu. The built-in-test (BIT) system is partially active during warm-up and becomes fully active after the warm-up period.
On units fitted with the Rubidium Reference Oscillator, R(f) option, all BIT responses from the Rubidium oscillator are inhibited during the first seven minutes of operation. This is to avoid continual spurious fault indications as the Rubidium oscillator's internal circuits settle into their normal state.
At the end of this period, there may be a brief fault indication as the BIT system restores the Rubidium monitoring, but this should clear promptly without intervention.

MANUAL OPERATION -- via front panel

Display Window

The front-panel display is a 2-row x 40-character VFD showing alphanumeric data relating to the current values of Time and Date and to the units' status and settings.
The display can be set to operate at one of four preset brightness levels, according to the ambient lighting scenario. [See DISPLAY button below]
The display optics maintain good readability over a wide range of off-axis viewing angles, to beyond $\pm 30^{o}$, both vertically and horizontally.
It is recommended that the 2804A unit should be rack-mounted at a height corresponding to nominal eye-level to give best all-round readability and to avoid partial obscuration of the display characters by the window edges.

To maximise display life, and to avoid contamination of the display phosphors by continuous display of the same legend, the display-driver software has a shut-off feature similar to the screen-saver on a PC.
If there has been no front panel (button) activity for a period that exceeds twelve minutes, then the display will be switched off.
To restore the display at its previous page setting, touch any button briefly.
Note: There is a short delay [circa 1 second] before the display illuminates due to the start-up time of its internal power converters.

Control Buttons

The control buttons are grouped at the right hand side of the front panel, they allow control and setting of the units' functions when used in conjunction with the display pages listed above.
The buttons legends and colours are:

DISPLAY	Blue
PAGE	Black
SELECT	White
ROLL +	Grey
ROLL -	Grey
ENTER	Orange

The Button functions are:

DISPLAY -- Controls Display Brightness (Intensity).
Successive pushes sequence the display through four Brightness levels

PAGE -- Allows sequential selection of display pages.
See section below for details of display page sequencing

SELECT Allows 'selection' (marking) of a particular parameter or function within a displayed window, as a precursor to setting that function or entering data.
The selected item on the display is marked initially by a broad arrow symbol to the left of the item's legend. Pressing the SELECT button will move the arrow from one function to another within that window.
When then data-entry state has been set using the ENTER button (see below), the SELECT button will now allow selection of particular digit groups, the broad-arrow pointer moving to indicate which digit group is to be set.
Selected digit groups may then be rotated to different values using the ROLL buttons (see below)

ROLL + and ROLL - These buttons allow displayed and selected data to be incremented [+] or decremented [-] to allow setting of a required parameter or numerical value.
Where data entry involves several digits, they are selected and entered in convenient groups. Only those that are selected (and therefore marked by the broad arrow pointer) will be adjusted by the ROLL buttons. Where the symbols + or - are to be set, either the ROLL+ or the ROLL- button may be used to switch between the two states, i.e. either button will act as a 'toggle'.

ENTER Used firstly to 'arm' the data-entry state, and secondly to terminate data-entry action, confirm setting of a value, and exit the data-entry state. To 'arm' the data-entry state, push and continuously hold-in this button for more than two seconds; this hold-off is an anti-tamper feature.
Where data are being entered in digit-pairs within larger groups, such as when setting Time or Date, adjustment of all the digits in the group concerned should be completed using the select and roll buttons before ENTER is pushed to confirm the data.
This will cause exit from the data-entry state, and further setting operations will require the four-second push to re-enter the 'Armed' state for data entry.

Spare button
A spare button is fitted under the PAGE button. This is fitted with a black top and is unmarked so that it is visually unobtrusive in day-to-day use.
Its purpose is to allow for any additional software feature requiring an additional button that may be added as a result of operational experience with the unit.
With the existing software issue, pressing this button will have no effect (except to restore the display when it has been shut off by the display saver -- any button will do this)

Wrong button warning
Inappropriate use of any button will result in a short beep from the internal sounder.

Example: pressing SELECT when not on a SET or TEST Menu page.

The Display Page Sequence

The 2804A has a total of more than twenty five different display pages, that are used for various purposes including the display of data, control of the unit, and interrogation of its status. These pages are selected for display manually by means of the dedicated control button marked PAGE.

Each time the PAGE button is pressed, the display will switch to the next page in a sub-sequence or 'menu' as depicted in Drg. No. 3870-7049.
To avoid the tedium and inefficiency of circulating through *all* the pages in order to find a particular target, they are divided into three 'Menu' groups.

1. The MAIN Menu, includes only information pages that are likely to be of routine interest in day-to-day use; there are no user-set items within this menu.

2. The SET Menu, where operating parameters of the unit may be changed; a majority of the unit's user-set features and settings are accessible through this menu.

3. The TEST Menu, showing test facilities and details of recent performance history; there are a limited number of user-set items within this menu.

In each menu, all the display pages have exclusive names, these are at the top left-hand corner. The page names are allocated as shown in the tables overleaf, where the function of each page is briefly described.

The MODE page

The choice of menu to be displayed is made on the MODE page.
As each Menu is explored via the PAGE button, the sequence always passes through the MODE page which appears in each menu, allowing the user to switch to the MAIN, SET or TEST Menus as required.

If it is required to 'jump' directly to the MODE page, this can be achieved from any point in the menus by holding down the PAGE button for two seconds.

The Panel Lock feature

The lower field on the MODE page also allows switching between the panel-locked and panel-unlocked states.

In this context, the term 'locked' applies only to *the inhibition of setting operations.*
The locked state does not interfere with navigation through the Menus to any display page, which can still be achieved using the PAGE button.
However, if the locked state is in force, any attempt to change the setting of a parameter or enter data will be ineffective, and an audible reminder 'Beep' will be heard.

To minimise the chances of accidental disabling of the of the panel lock it is necessary, in this case only, to hold down the ENTER button *for 8 seconds* in order to enter the panel lock field.
(This anti-tamper delay is only 2 seconds in all other cases)

NOTE: The SET and TEST menus contain some setting facilities that are operationally sensitive.
Arbitrary or accidental adjustments to certain parameters may cause incorrect or erratic behaviour of the unit. Users are therefore advised to adopt the policy of operating with the panel lock enabled unless a specific decision has been made to alter a non-sensitive parameter.
After any such adjustment, the panel lock should be re-enabled.

The most sensitive parameters are identified in the sections describing the SET and TEST menus

Drg. No.3870-7049 -- 2804A Display Pages -- Sequence Diagram

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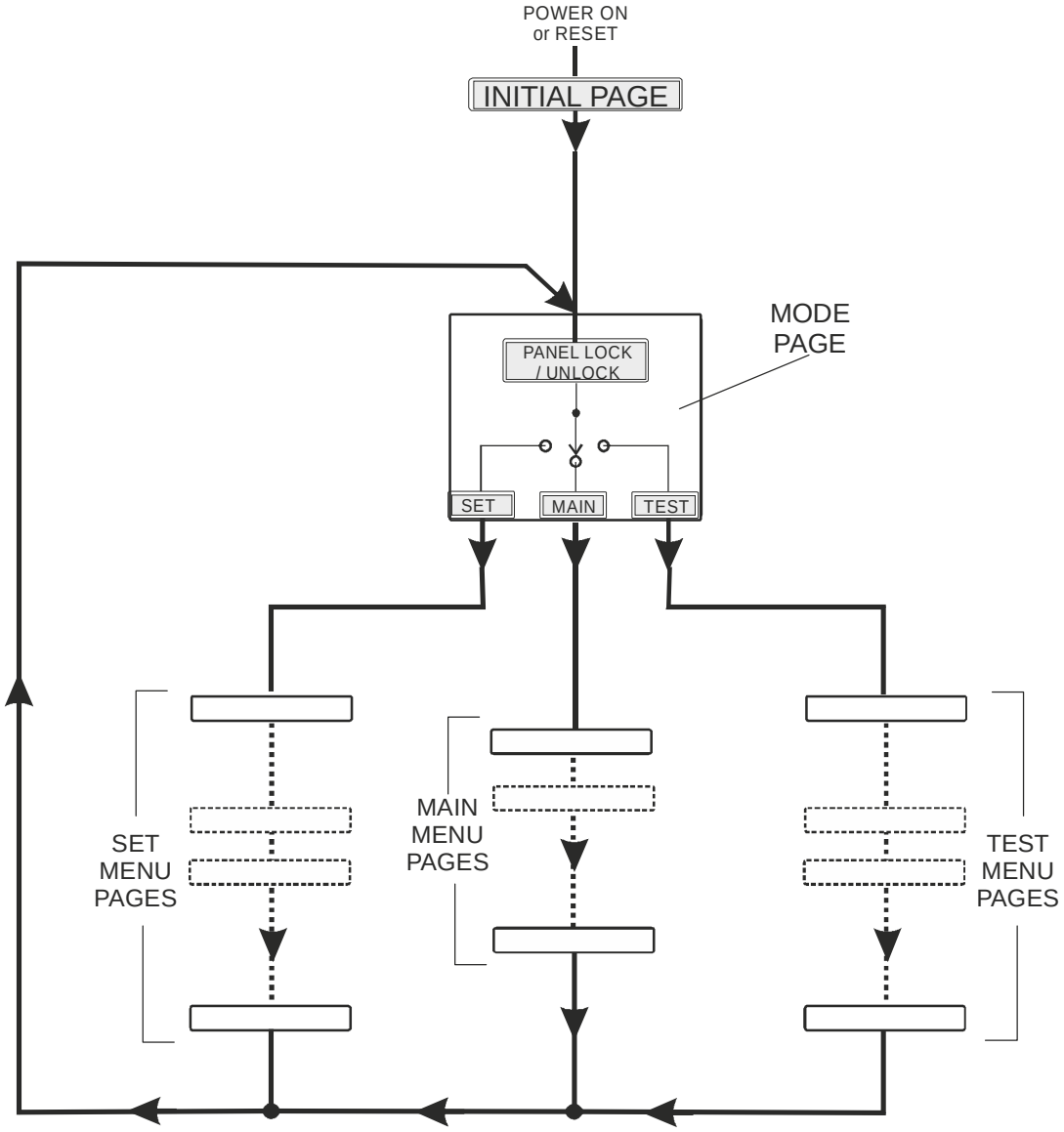
2804 DISPLAY PAGE SEQUENCE DIAGRAM



DRAWN : TMB	**DATE :** 28 09 01		
CHECKED : PLB	**DATE :** 28 09 01	7049cHB	
DRG No. 3870 - 7049		**ISSUE** C	
MOD No. 1215, 1311			

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Display Page -- Name List

NOTE: ** indicates page may be omitted -- dependant on options fitted

MAIN MENU	
PAGE NAME	**FUNCTION**
MODE	Allows Menu choice, & Panel Lock/Unlock
STATE	Current status of unit
TIME	Current UTC & Local Date/Time
EVENT	Recent 'external event' Date/Time log
GPS 1	Current GPS Position, Velocity, Fix-quality data
GPS 2	Current GPS satellite PRNs and SNRs
FAULT	Current fault status

SET MENU	
PAGE NAME	**FUNCTION**
MODE	Allows Menu choice, & Panel Lock/Unlock
SET	Aux Alarm function set, Oscillator control lock, Buzzer inhibit
TIME	Current Date/Time -- option to manually set
DST	Mode / Shift / Start / End of Daylight Saving Time (UK BST)
PPS	1Hz / 1pps output parameters & Timing compensation setting
FREQ ******	Synthesiser (S option) & Aux (fx) (J option) frequency setting
CODE	Timecode Type / Epoch select & Control bits setting
REM D ******	Remote Display unit Type / Epoch select
SER 1	Com Port parameter selection (Format for COM-1 and COM-2)
SER 2	Com Port parameter selection (Mode for COM-1 and COM-2)
ALARM	Alarm delay setting

TEST MENU	
PAGE NAME	**FUNCTION**
MODE	Allows Menu choice, & Panel Lock/Unlock
TEST	Unit software reset, Test
POWER	Internal power supply rail Voltages
OSC 1	Reference Oscillator parameters internal & supply voltages
OSC 2	Reference Oscillator type & control values
LOOP	Reference Oscillator control-loop parameters
HIST1	Recent Oscillator control-loop behaviour
HIST2	Earlier Oscillator control-loop behaviour & averages
HIST3	Power-on and GPS-reception monitor
LEAP	Forthcoming Leap-Second & handling mode
GPSRx	GPS receiver version, mode setting & GPS Week Number
VERSN	Unit Version and Options fitted

Display Page -- Characteristics

The Display Pages are illustrated in Drg No.3870-7051 (Sheets 1, 2, 3), below.
These sheets show the typical appearance of pages within each menu; arbitrary data values are depicted.

General Features

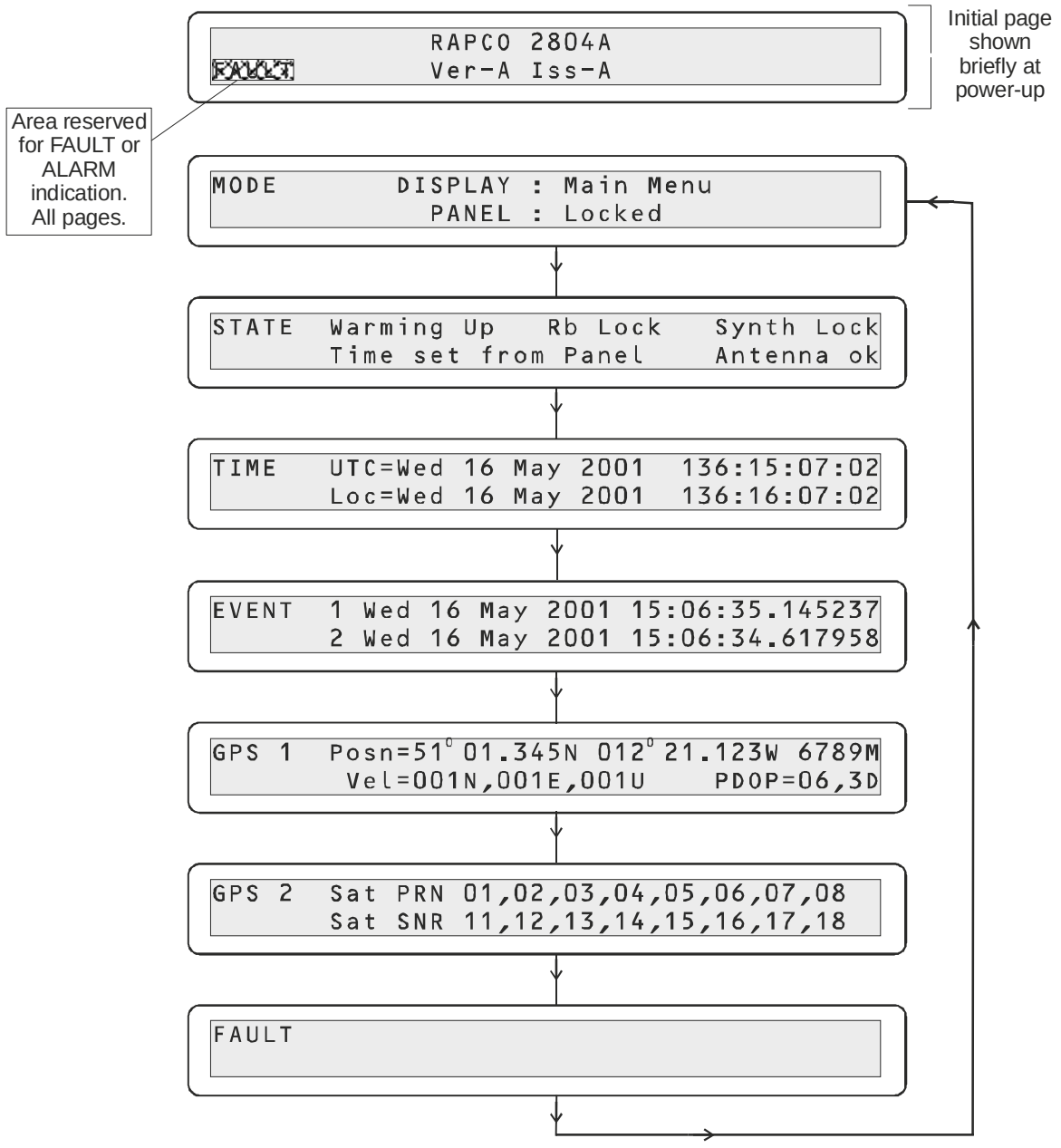
All pages are designed to provide best readability within the constraints of a 2 x 40-character presentation space.

With the exception of the Initialisation page, which is shown only briefly at power-up or following a Reset, the page title is displayed at the upper left end as, for example, 'MODE' or 'TIME' or 'STATE' etc, according to its function.

The lower-left area is a reserved space where a FAULT or ALARM message will be displayed if the BIT system has detected a problem or if an alarm state exists. This message will be inserted in the same reserved position regardless of which display page is currently in use, so as to ensure that an operator is made aware of any fault.
To assert their presence, both the ALARM and FAULT messages flash on and off at one second intervals.
There is, in addition, a front-panel BIT fault-indicator led that is described separately below
An ALARM message gives warning of a condition that arises due to abnormal conditions in the unit's frequency control system.
This may arise due to loss of the GPS Timing reference or to other conditions in the oscillator control loop that are not normal. An ALARM does not necessarily indicate an immediate fault in the unit's output signals, but may be a precursor of such a condition.
If an ALARM message occurs in the display window then either the CONTROL status led or both the CONTROL and GPS status leds, will be switched off.
If a BIT detected fault state occurs, the FAULT message will override any ALARM message indication in the display window.

Details of the individual page features follow below.

2804 DISPLAY PAGES -- MAIN MENU



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MAIN MENU

SEE Dwg No 3870-7051 Sheet 1

NOTE: EXCEPT FOR THE PANEL-LOCK STATE ON THE MODE PAGE, WHICH IS COMMON TO ALL THREE MENUS, THERE ARE NO USER-SETTABLE PARAMETERS WITHIN IN THE **MAIN** MENU PAGES.

Description, Initialisation and STATE *Pages*

The Initialisation page is shown only following power-up, or if the unit has been Reset; from either the front panel or by a command at one of the Com Port interfaces.
It displays the unit Type number, and the software version with which it is fitted.
This page will be shown only for a four-second period, or until the PAGE button is pressed, if this occurs within the four-second period.

The **STATE** page is then displayed; this shows [at upper left] the current status of the unit as:

WARMING UP	Shown for a period following power-up (30 min approx)
PPS LOCK	Shown when the Timing output signals (1Hz, 1pps) are aligned with the UTC on-time point. Normally shown during warm-up period, but may re-occur following GPS signal loss etc.
FREQ. LOCK	Shown when the oscillator frequency-control loop is functioning. Overwrites the PPS LOCK indication, because PPS lock is essential for frequency lock to be maintained
INACTIVE	Shown, after completion of the warm-up period, when the oscillator frequency-control loop is unable to function due to lack of a valid GPS reference signal.

The source from which the Time and Date settings were last made is shown [at lower left].
The Time and Date sources are:

RTC (Real-Time Clock hardware)	This provides approximate Date/Time setting immediately after power-up.
GPS (built-in receiver)	In situations where the GPS Receiver is achieving a Fix.
SERIAL (either control interface)	When a Date/Time setting command has been received at Com Port 1 or 2.
PANEL (manual entry via buttons)	Following a valid manual entry.

Additionally the STATE page shows [at lower right] if the current state of the GPS Antenna interface. This indication is based on a hardware test from the GPS Receiver.

ANTENNA FAIL	Indicates that the dc feed current in the Antenna downlead cable is outside its normal limits.
ANTENNA OK	Indicates that the dc feed current in the Antenna downlead cable is within its normal range.

NOTE:The Antenna test cannot detect an rf performance failure in the Antenna system.
If the unit is operating with a dc-blocked splitter feed or with an external dc-blocked GPS Amplifier, the 2804A software will clear the ANTENNA FAIL indication as soon as a valid Fix is achieved, regardless of the Antenna feed-current measurement.

Other items that may be shown on the STATE page relate to optional-fit items; these are:

Rb LOCK	Indicates that the optional Rubidium oscillator assembly [R option] has locked its internal PLL. This keeps its output frequency accurate with reference to the microwave frequency from the atomic physics package
SYNTH LOCK	Indicates that the optional Synthesiser card [S option] has locked its internal PLL. This loop keeps the synthesisers on-board clock frequency accurate with reference to the 2804's reference frequency.

Description, **TIME** *Page*

The current UTC data is shown on the top line of this page as follows:

DAY, DAY-OF-MONTH, YEAR, DAY OF YEAR, HOUR, MINUTE, SECOND

The lower line shows the current 'Local' time in the same format. This will differ from UTC by a preset (user-defined) amount, the Local Offset parameter.

Description, **EVENT** *Page*

This page is devoted to the display of data from the unit's event timing facility. Up to eight event times can be logged, these are entered into memory sequentially and labelled 1, 2, etc.
On entry to this page, event times 1 and 2 from the current log are shown.
Pressing the SELECT button briefly will result in the display of events 3 and 4.
Similarly, 5 and 6, and 7 and 8 may be displayed.
See separate handbook section below regarding detailed operation of the Event timing facility.

Description, **GPS 1** *and* **GPS 2** *Pages*

GPS related information is shown on two pages, GPS 1 and GPS 2

GPS 1 shows [In the top line] the Current GPS Fix (position) as:

Latitude in Degrees, (integer 0 to 89) and Minutes, (0 to 59.999) South (S) or North (N)
Longitude in Degrees, (integer 0 to 179) and Minutes, (0 to 59.999) East (E) or West (W)
Height above WGS-84 datum msl (0 to9999) M indicates Metres

If the GPS system is active, but has not achieved a valid Fix since power-up or Reset, then default position values will be shown.
The GPS receiver's own default is to 37^{o} 23.481S 122^{o} 02.258E 0002M which is the location of the manufacturer's plant in Sunnyvale, California, USA.

This page also shows [at the lower right corner] the current PDOP, and the level of Fix achieved
PDOP is a 'Fix quality' statistic used in GPS systems to define the probability of fix accuracy; it is based on available Satellite geometry. The US DoD definition of fix accuracy requires that the achieved PDOP figure is 06 or less (lower PDOP = higher quality).
The level of fix [at the lower right corner] may be shown as 1D, 2D or 3D
The PDOP field shows a NO FIX message when no fix is being achieved

The lower line contains the current GPS Velocity readout giving three-axis components as:
North/South (N/S) East/West (E/W) and Up/Down (U/D).
Units of each velocity vector are metres/second.

GPS 2, shows two lists of satellite data.

The upper row of numbers represents the satellite PRN (identity codes) that are currently available (according to the Almanac). The lower row shows the 'signal level' that is current for each of the satellites that is actually being received.

The appearance of a satellite PRN (identity) in the top row does not guarantee that *that particular* satellite can actually be received. For example, it may be flagged as unhealthy, or it may be obscured at certain times due to imperfect Antenna siting.
The number of satellites visible above the horizon of a well-sited Antenna will vary throughout the day and night. The receiver is capable of simultaneous correlation on up to eight satellites, but at times only four or five may be visible.
The 'signal level' data displayed are not 'analogue' measurements and do not represent a decibel power scale; rather they are an indication of the correlation coefficient that is currently being achieved for each particular PRN. They relate to signal-to-noise ratio, rather than signal power, but despite this, they are a good indicator of the general reception conditions.
The receiver will normally continue to correlate with indications down to 04 and, with an overhead satellite whose signals are not degraded by local interference or multi-path propagation, the number displayed can range well over 20. Typically, good reception will show several satellites with levels of 10 or more, with all the values rising and falling over periods of hours as the satellites track from horizon to horizon.

Description, **FAULT** *Page.*

The Fault page shows items detected by the BIT system. Because of the number of detectable fault conditions, the messages displayed on this page are summarised to fit into the available space.

It is the case that certain types of fault may trigger a number of responses from the BIT system.
For example a power-supply malfunction may cause several circuit areas to fail or to operate out-of-limits simultaneously, and this is another reason forallocating a priority level to the Fault page messages.

In the case where no fault is being indicated by the BIT led is off, and the FAULT page shows a centrally located message NO FAULTS. During a period following power-up, this page will also show a message 'WARMING-UP
When a fault is being detected by the BIT system, all other pages carry a FAULT message in the lower left corner, and the red led BIT indicator is lit. Under these conditions, selection of the FAULT page will show one or more messages in four reserved display areas.
The messages that may be displayed in each of these areas are as follows:

AREA 1	ADC loop	AREA 3	10MHz
	Rb power		Rb lock
	dc conv -		Rb comms
	dc conv +		Rb limit
	DAC loop		
	Rb ref v		
	dc power		
	ac power		
AREA 2	Int Clock	AREA 4	GPS 1pps
	NV Memory		GPS i/f

These messages shown, individually or in combination, assist in identifying the area where the fault is occurring. A more detailed analysis of the fault can be made by use of the RCF (Read Current Faults) command which returns all BIT detected faults.

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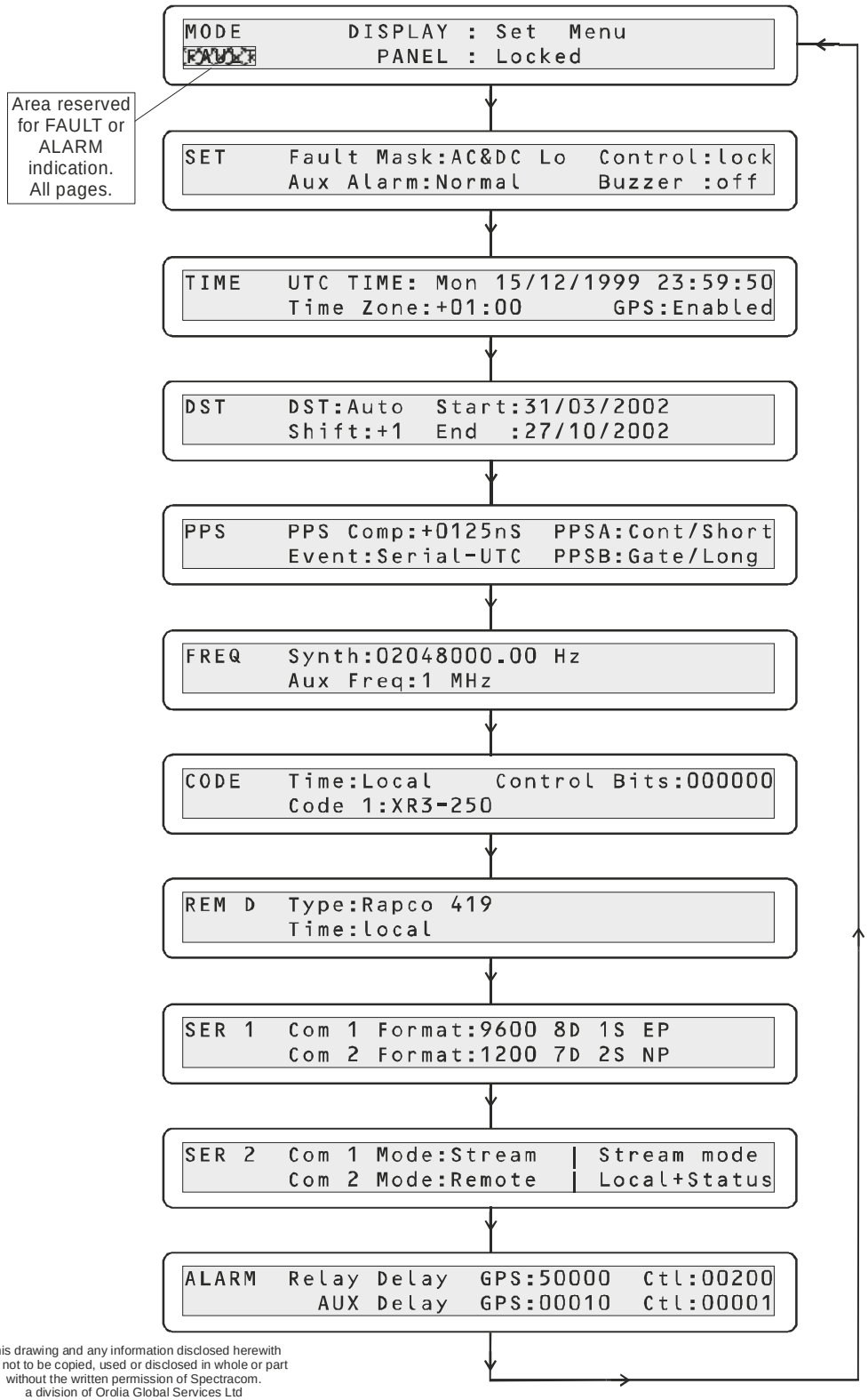
2804 DISPLAY PAGES -- SET MENU



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SET MENU

SEE Dwg No 3870-7051 Sheet 2

NOTE: THE SET MENU INCLUDES SOME SETTING FACILITIES THAT ARE OPERATIONALLY SENSITIVE. ARBITRARY OR ACCIDENTAL ADJUSTMENTS TO SOME PARAMETERS MAY CAUSE INCORRECT OR ERRATIC BEHAVIOUR OF THE UNIT; CAUTION IS THEREFORE REQUIRED IN SPECIFIC CASES.
THE MOST SIGNIFICANT EXAMPLE IN THIS MENU IS:
CHANGING THE **SET** PAGE **CONTROL** FIELD TO **LOCKED**.
SUCH ACTION WOULD DISABLE THE OSCILLATOR FREQUENCY CONTROL-LOOP.
SEE PREVIOUS NOTES REGARDING THE PANEL LOCK FEATURE.

Manual Setting Technique

The use of the Front Panel buttons to select or set operating features, or to enter data values is similar regardless of which item is being set. The exact function of each button is defined at the start of this section.

Description, SET *Page*

This first page in the SET Menu sequence allows setting of four 'background' control features that are unlikely to required attention in day-to-day operation of the unit.
The upper-left field controls a Fault Mask facility that inhibits a fault indication under certain conditions.
This facility allows the nuisance of a continuous alarm indication to be avoided when the conditions that lead to it are normal in the application scenario that prevails.

The maskable Alarm conditions are a.c. Fault and d.c. Fault.
An a.c. power fault indication, unless masked, would be shown continuously if the unit were operated from only d.c. supplies, as might be the case in mobile use.
Similarly, if the unit was operated from a.c. supplies without any d.c. back-up, a continuous Fault would be shown; the a.c. fault mask allows this to be suppressed.
Both a.c. and d.c. power fault indications can be suppressed if required.

The upper-right field on this page allows selection of a LOCK or RUN state for the Reference oscillator control loop. In normal operation this should be set to RUN to achieve normal GPS control of the oscillator's frequency with regular correction of its ageing characteristic.
The LOCK setting might be used in a situation where it was required to suppress automatic adjustments of the oscillator, for example in certain test situations.

The lower-left field allows selection of NORMAL or SPECIAL state for the auxiliary Alarm (Alarm-2) output (discussed in the ALARM OUTPUTS section). In routine operation the NORMAL state should be selected, since the SPECIAL state definition allows the Auxiliary Alarm signal to operate in a dual-role mode that is not implemented in a standard 2804A unit.

The lower-right field allows the 'beep' sounder (Buzzer) to be suppressed in any situation where it might prove to be annoying to the user.

Description, TIME *Page*

This page shows the current (UTC) Day-of-Week, Date and Time values on the top line, and the Time Zone parameter on the bottom line.
The Time Zone value is the user-defined difference between UTC and the Local time at the installed location.
The Time Zone definition describes the normalised time offset due to the geographical seperation (i.e. Longitude difference) between the installed location and the Greenwich Meridian.
Because there exist certain timezones that are defined *between* 1 hour boundaries, the value of the offset can be entered as an Hours and Minutes. In the U.K. the correct setting is to 00h 00m.

Note that the Time Zone definition is not connected with any Daylight Saving (DST) offset that may also apply in certain locations and at certain times of year; this is dealt with completely separately.
See DST Page definition below.

The Day of Week, Date and Time values in the top line can also be user-defined when it is desired to run the unit with the output Time epoch set in the Past or the Future.
To do this, it is first necessary to disable the process by which the GPS receiver continually updates the time.
The lower-right field on this page allows the user to select either GPS ENABLED or GPS INHIBIT.
Note that these definitions apply only to time-setting operations; other GPS activities such as the 1pps timing pulse output and oscillator control will continue regardless of the setting, provided that the receiver is doing a valid Fix.

If GPS ENABLED is selected *and the GPS receiver is doing a valid Fix*, then attempts to set the Time manually will fail because the cursor will not enter the Time setting field, and the sounder will 'beep' as a reminder.
The 1Hz Timing pulse, Timecode output/s etc., will remain aligned with UTC.

If GPS ENABLED is selected *but the GPS receiver is **not** doing a Fix* it will be possible to set the Time. As soon as the time is entered however, the 1Hz Timing pulse, Timecode output/s etc., will realign to the moment in time that the Enter button is pressed.
In this situation, if GPS receiver operation is later restored, and it achieves a Fix, it will overwrite the Time entry and retime the 1Hz, Timecode/s etc., to align with UTC.

If GPS INHIBIT is selected, the Time may be entered manually, but the 1Hz, Timecode/s etc., will remain aligned with UTC, i.e. the redefined timescale will commence at the next 1Hz event after the Enter button is pressed
The 1Hz UTC alignment process and oscillator control will continue in the background, provided that the receiver continues doing a valid Fix. If the GPS receiver looses its Fix in this situation, the unit will continue to operate normally with accuracy defined by the internal reference oscillator in its stand-alone mode.

Description, DST *Page*

This page facilitates management of the unit's Daylight Saving Time (DST) handling. In certain parts of the world DST is colloquially known by other names such as Summer Time (ST), British Summer Time (BST) etc.
In Europe there is a current convention for the harmonised application and removal of the DST offset.
The DST offset is a 1 hour advance from local time in the Time Zone concerned, and this is applied from the last Sunday in March until the last Sunday in October, the application or removal of the offset being initiated at 01:00:00 UTC on the Sunday concerned.
If the DST field in this window is set to AUTO, the unit will calculate the date corresponding to the Sundays concerned, and these date values will be entered in the START and END fields.
The value in the SHIFT field must be manually set. Factory test routines will by default, enter +1 (hours) in this field corresponding to the European norm.
If local requirements call for 'double DST' then +2 (hours) must be entered.

If the DST field is set to MANUAL, user-defined date values may be entered in the START and END fields.
According to the settings of the SHIFT, START and END fields, the unit will switch the LOCAL output Timescale to the required settings in accordance with the values entered.
DST application time (Start and End) is always 01:00:00 UTC and cannot be changed by the user.

If the DST field is set to OFF, then switching to DST is inhibited regardless of the SHIFT, START, or END field settings. In this case the Local Timescale will run at the TIME ZONE offset from UTC (defined elsewhere) with no DST discontinuities occurring.
All states and values shown in this display window will be stored in non-volatile memory and will self-restore after a power break.

Description, PPS *Page*

This page allows management of the unit's Timing pulse output signals and its event marking (time-tag) input feature.

The PPS COMP field allows entry of a time period value in units of nanoseconds and in the range ± 3000 nanoseconds.
This value will adjust the Timing output relative to UTC (earlier, if +ve or later, if -ve), in order to compensate for non-standard Antenna/Downlead cable delays that may prevail at certain installations.
If this field is set to zero, then the unit will be set for optimum alignment between the Timing pulse output and (UTC-GPS), taking into account known delays and offsets in the 2804's logic plus the delay in a Spectracom Type 5b Antenna, its LNA and a 50 metre E244 downlead.
If non-standard antennas, signal amplifiers or cables are used, consult Spectracom for advice on setting this parameter.

The PPSA and PPSB fields are used to enter definitions of the TIMING (1Hz/1pps) output signals behaviour at J17 (A) and J18 (B). Different settings are allowed for each output.
The choices are:

CONT -- Timing signal to continue in the event of GPS loss (i.e. normal stand-alone behaviour)
or
GATE -- Timing signal to be inhibited in the event of GPS loss.

In addition, the output pulse duration may be chosen as:

LONG -- 500 milliseconds i.e. a 1Hz squarewave.
or SHORT -- 10 microsecond positive pulse.

Thus, each field may be rolled to one of four settings

CONT/SHORT
CONT/LONG
GATE/SHORT
GATE/LONG

The factory set default is to CONT/LONG, giving a 1Hz squarewave timing signal that continues under control of the unit's frequency reference if the GPS signal is lost.

The remaining item on the PPS page is the EVENT field.
This allows the user a choice of operating mode for the event marking (time-tag) facility in the 2804A.
The unit will log an Date/Time reading for each input event; the timescale used may be UTC or LOCAL.
The input event marker may be provided in one of two ways:

A TTL pulse applied to the 1pps INPUT connector (J29) on the unit's rear panel,
or
An ASCII # (number) character sent to either of the serial COM ports.

Thus the four possible settings for this field are:

Pulse-UTC Pulse-LOCAL Serial-UTC Serial-LOCAL.

All states and values shown in this display window will be stored in non-volatile memory and will self-restore after a power break.

Description, FREQ *Page*

If the S Option is fitted, this page allows the user to set the output frequency at the Synthesiser output port connectors. If the S option is not fitted, the upper field in this display page will be absent

Settings are entered in the SYNTH field which contains a ten-digit decimal definition of the required frequency in Hertz to a resolution of 0.01 Hz
The factory default setting is to 02048000.00 representing a frequency of 2.048 MHz.

If the J option is fitted, another output frequency (designated fx) is available at an output port J26.
The fx output is derived by division from the reference frequency oscillator and can be selected from a list of choices accessible in the AUX FREQ field.
This option is mutually exclusive with the S option (see above)
If the J option is not fitted, the lower field in this display page will be absent

The FREQ page is entirely omitted on variants that have neither the S nor the J option.

Description, CODE *Page*

This page allows set-up of the Timecode (1) output channel (J15, J16) that is a standard feature of the 2804A
The TIME field enters the timescale that is required in the Timecode output data; this field may be toggled between and UTC and LOCAL

The type of Timecode required is set in the CODE 1 field, the choices being IRIG-A, IRIG-B, XR3-250, and XR3-1K. (or 2137 code).
If the selected Timecode is either of the IRIG types, then 24 of the Control Bit fields in the encoded data frame may be encoded with a binary value.
These bits are defined by entry in the CONTROL BITS field of a six-digit Hexadecimal number.
e.g. AAAAAA would set 010101010101010101010101 into the control bits of the Timecode frame.
(IRIG encodes the least significant bit first)

If the SMPTE Timecode option is fitted, the CODE 1 field is not settable and will display SMPTE.
The TIME setting field is still valid in this case and will apply both to the Timecode 1 (SMPTE), and the Timecode 2 output (if fitted).
The CONTROL BITS field is also active, data being entered into the Timecode 2 channel, provided that is set to an IRIG code type.

Description, REM D *Page*

This page allows selection of data to be broadcast to a Remote Display unit, connected to the unit's Remote Display output port at J27.

The type of display unit to be driven is defined in the TYPE field as Spectracom 419 or LEC.
These display units groups use different data encoding. The 419 selection covers all Spectracom types including the 1405.
The lower field selects the timescale to be displayed as UTC or LOCAL.

The REM D page is omitted on variants that have SMPTE Timecode option.

Description, SER 1 *Page and* SER 2 *Pages*

These pages jointly define operation of the Serial interface ports that are designated COM-1 (J5) and COM-2 (J6) on a standard 2804A.
Although these ports have identical capabilities, they can be set independently as regard Mode (STREAM or REMOTE) and Protocols (Baud rate etc.).
The data content of the STREAM mode (broadcast) message may also be selected, but the setting is common to both ports

On the SER 1 page, the upper field selects Baud Rate, Data bits, Stop bits and Parity for the COM-1 port J5
The lower field on this page selects Baud Rate, Data bits, Stop bits and Parity for the COM-2 port J6

On the SER 2 page, the mode of operation (STREAM or REMOTE) is selected for COM-1 in the upper left field and for COM-2 in the lower left field.
On the lower right of the SER 2 page, the data content of the STREAM mode (broadcast) message for both ports is set to one of four choices.
These are

UTC + STATUS	(UTC Date/Time every second, plus GPS status every ten seconds)
UTC TIME	(UTC Date/Time only, every second)
LOCAL + STATUS	(LOCAL Date/Time every second, plus GPS status every ten seconds)
LOCAL TIME	(LOCAL Date/Time only, every second)

Description, ALARM *Page*

This page allows user setting of the Alarm output signal delays (hold-off times).

There are two alarm signal channels from 2804A, one is the ALARM (contact) relay connection at J19 and the other is a separate TTL signal that is output via the D.C.OUTPUT connector for signalling an Alarm state to an external Autochangeover/Distribution unit.
The Delay (Hold-off) time may be set to different values for each of these two outputs.

There are two delay setting definitions for each. One is that applying to a GPS Alarm (Loss-of-Fix) and the other applies to the CONTROL Alarm that monitors the reference oscillator control loop.
The upper field on this page sets the Relay Delay, GPS and CONTROL for the J19 output (Alarm-1), whilst the lower field sets Aux Delay GPS and CONTROL for the TTL output. (Alarm-2 in J3).

These settings are discussed in more detail in a separate section of this Manual, ALARM OUTPUTS
In applications where the d.c. output connector (J3) is not used, then the settings for the Alarm-2 channel may be ignored.

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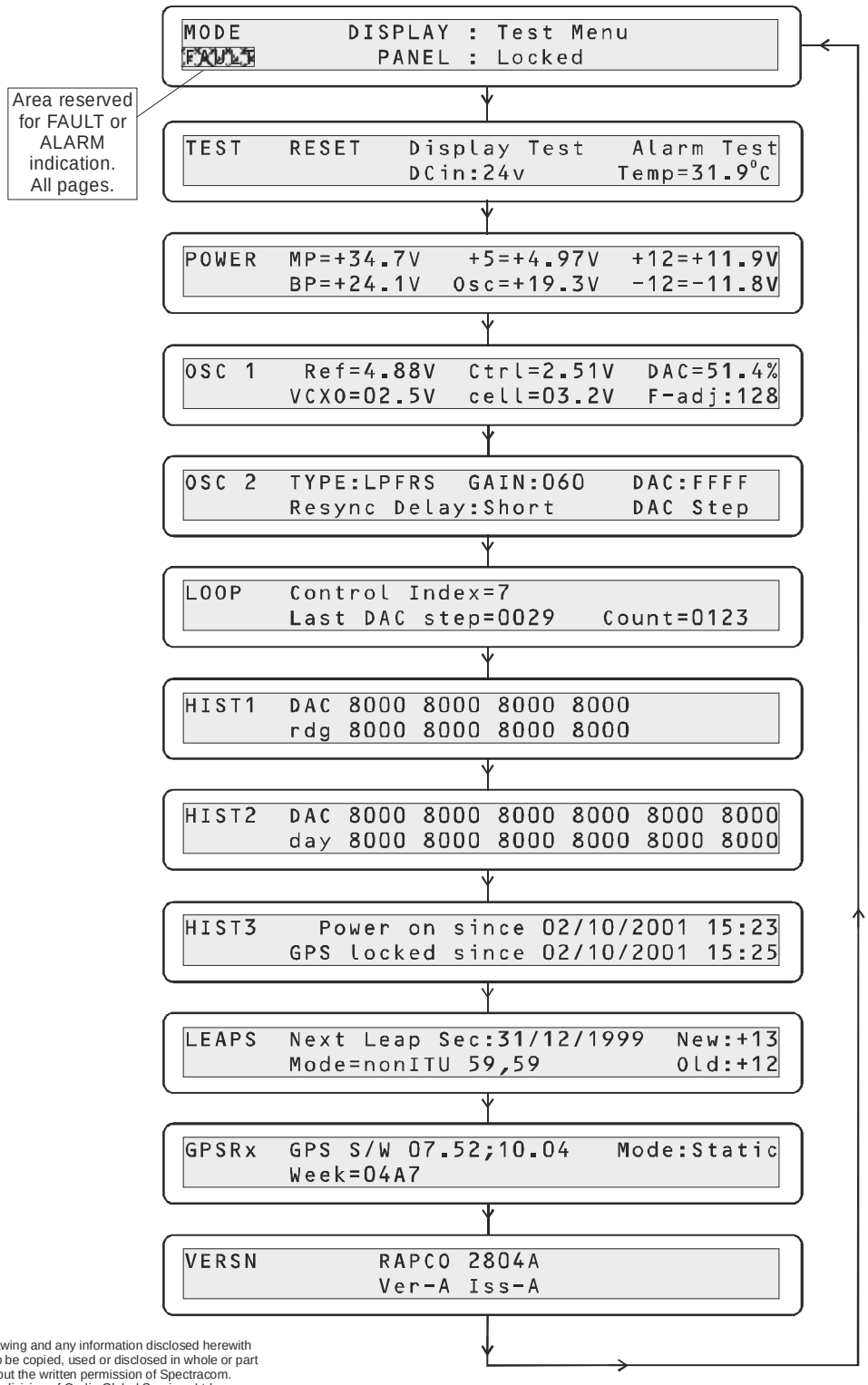
2804 DISPLAY PAGES -- TEST MENU



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TEST MENU

SEE Dwg No 3870-7051 Sheet 3

NOTE: THE TEST MENU INCLUDES SOME SETTING FACILITIES THAT ARE OPERATIONALLY SENSITIVE. ARBITRARY OR ACCIDENTAL ADJUSTMENTS TO SOME PARAMETERS MAY CAUSE INCORRECT OR ERRATIC BEHAVIOUR OF THE UNIT; CAUTION IS THEREFORE REQUIRED IN SPECIFIC CASES.
SIGNIFICANT EXAMPLES IN THIS MENU ARE:

THE SOFTWARE **RESET** FIELD IN THE **TEST** PAGE
THE **F-ADJ** FIELD IN THE **OSC 1** PAGE **[IF R OPTION IS FITTED]**
THE **GAIN**, AND **DAC** AND **DAC STEP** FIELDS IN THE **OSC 2** PAGE

ANY ADUSTMENT TO THESE SETTINGS COULD HAVE AN IMMEDIATE AND SIGNIFICANT EFFECT ON THE OSCILLATOR FREQUENCY.
SEE PREVIOUS NOTES REGARDING THE PANEL LOCK FEATURE.

Description, MODE *Page*

This page appears in all three menus. It allows switching from one menu to another, and also carries the Panel Lock (inhibit setting) facility.

Description, TEST *Page*

This page allows software RESET, DISPLAY TEST or ALARM TEST to be initiated.
Initiating RESET will cause loss of many stored parameters and will result in a long recovery period to normal operation.
DISPLAY TEST initiates a full test of the display electronics package.
Alarm TEST initiates output of an Alarm state signal at both the relay and TTL Alarms which will be sustained for 10 seconds before clearing to the normal state
The page also displays the d.c. input (back-up power) configuration of the unit as 24V or 12V. [this is a hardware set-up indication, *not* the applied voltage measurement]
[The actual d.c. input voltage being applied is measured, and is shown as Backup Power (BP) on the following POWER page]
The remaining (lower-right) field shows the internal temperature of the unit measured in degrees centigrade

Description, POWER *Page*

This page displays the results of six d.c. voltage-rail measurements performed by the BIT system.
The upper-left field shows Main Power rail (MP) measured as the voltage at the output of the transformer/rectifier circuit, prior to regulation. It will vary with applied a.c. voltage, typically it is +32V at nominal 230V rms mains voltage.
The lower-left field shows the Back-up Power (BP) voltage applied at the d.c. input connector. If no d.c. connection is made there may still be shown a small residual voltage.
The upper-mid field shows the +5V regulated logic and processor supply rail voltage
The lower-mid field shows the reference oscillator regulated supply rail [Qz +12V, Rb +19V]
The upper-right field shows the +12V analogue circuit regulated supply rail voltage
The lower-right field shows the -12V analogue circuit regulated supply rail voltage

Description, OSC 1 *Page*

This page defines the current operating state for the unit's reference oscillator.
If the R (Rubidium-atomic) option is fitted, the parameters shown are:

(REF) d.c. voltage output / (CTRL) d.c. voltage input / (DAC) output (% of range).
(VCXO) internal control voltage / (CELL) photocell voltage / (F-ADJ) coarse freq. setting .

A 2804 unit with a Quartz Reference oscillator will display only the REF, CTRL and DAC values;

the other parameters do not apply to a Quartz oscillator.

Description, OSC 2 Page

This page defines various control-loop parameters for the reference oscillator.
For both Quartz and Rubidium Reference oscillators, the parameters shown are

TYPE of oscillator / Control-loop GAIN parameter / DAC input register / DAC STEP

The user-settable field RESYNC DELAY defines the duration allowed for a GPS signal-loss before the unit will re-time the 1Hz timing output on recovery of GPS signals.
Default setting = SHORT (10 Minute). The LONG setting gives 8 Hours
The significance of this setting is explained as follows:

> During a 'stand-alone' period, when there is no GPS signal to provide a control reference, the oscillator control-loop is disabled and the oscillator control voltage is held constant at the value that was in force at the time when the GPS signal was lost.
> In these conditions the oscillator frequency will drift at a rate that is determined by its environment and its ageing characteristic.
> If the 'loss of GPS' period is greater than the RESYNC DELAY period setting, then as soon as the GPS Fix is re-established, the 1Hz timing output and any associated timing signals (such as Timecodes) will be reset into UTC alignment. i.e. there will be a phase step in the 1Hz timing.
> The magnitude of this timing step will be dependent on the performance of the unit's reference oscillator during the 'stand-alone' period; i.e. how far off from UTC the 1Hz had drifted.
> When the 1Hz has been resynchronised in this way, the transient disturbance to the oscillator frequency when the control loop is re-enabled is minimised. This is because the error signal to the control-loop is the difference between the unit's 1Hz and the reference 1pps from the GPS, so the loop starts operating with a near-zero error signal.
> The frequency error that has accrued during stand-alone will then be 'steered out' by the control loop over the next few averaging periods.
>
> In the opposite case, when the 'loss of GPS' period is less than the RESYNC DELAY period, then re-synchronisation of the 1Hz is inhibited. This results in the control-loop being restarted with a large error signal, which in turn may cause a transient deviation in the Reference frequency; it may be several hours before full Accuracy is recovered.
>
> In applications (such as Digital Broadcasting) where coherence between timing and frequency outputs is of high priority, then the LONG setting for the RESYNC DELAY may be appropriate.
> In most other applications the highest overall integrity is achieved by using the SHORT setting.

Description, **LOOP** *Page*

This page provides a monitor of the behaviour of the oscillator control loop.

The CONTROL INDEX field shows a stability figure-of-merit that may range from 4 to 8 in value
4 is the state following a power break, and states 5, 6, 7, 8 represent improving behaviour as the oscillator stabilises and the control-loop reduces its bandwidth in response.
The most recent change in the control voltage is shown in the LAST DAC STEP field, and the COUNT field shows a hexadecimal counter that charts progress though the loop's averaging period in seconds.
This count value rolls-over to zero at the end of each averaging period; different averaging periods are used according to the type of oscillator.
The standard Quartz oscillator used in 2804 is run with a fixed averaging period of 512 seconds; in this case the maximum count will be 01FF.
Where the Rubidium-atomic oscillator [R option] is fitted the averaging time is varied automatically, by the software, according to operating conditions.
It will be 2048 seconds (maximum count 07FF) following power-up or in an unstable environment, or 8192 seconds (maximum count 1FFF) during normal settled operation under stable conditions.

Description, HIST 1and HIST 2 *Pages*

These pages show the recent history of the oscillator control loop DAC output.
They are 4 digit hexadecimal ranging from 0000 to FFFF.

On the Hist 1 page are the last eight readings; the most recent is at top-left, the oldest at lower-right .

On the Hist 2 page are the last 12 daily (midnight-to-midnight) averages of the DAC output; the most recent is at top-left, the oldest at lower-right .

Description, HIST 3 *Page*

The Hist 3 page shows the time when the unit was last powered-up (or Reset) and the time when the GPS receiver last entered the valid Fix state following power-up or loss of GPS signal.

Description, LEAP *Page*

This page shows the Date of the next scheduled Leap-second and the NEW offset from GPS time that will result from it, along with the OLD (current) offset from GPS Time.
If no Leap-second is currently scheduled, the Not Scheduled message will replace the Date, and the NEW and OLD fields will disappear from the window.
The MODE field allows user-selection of the Leap-second handling method as being either compliant with ITU recommendations or non-compliant.
Briefly, the ITU recommendation for the encoding of a positive Leap-second is that it shall be encoded as second 60.
Thus, in the minute leading up to midnight at the scheduled 'leap-time' there will be 61 seconds, and these are labelled numerically as 0, 1, 2, 3 etc. up to 57, 58, 59, and 60.
This can cause problems if user's software that is reading the time data is configured to reject a seconds-count value of greater than 59 as illegal.
An alternative method of encoding a leap second is therefore provided in the 2804A, where the closing seconds of the minute are counted as 57, 58, 59, and 59.
Unless there are obvious reasons to the contrary, the ITU defined method is recommended.

Description, GPSRx *Page*

This page shows the GPS S/W (receiver software identity), and the current operating MODE for the GPS receiver. (Air, Sea, Land, Static)
This MODE setting makes changes in the GPS receiver's processing algorithms that, in effect, trades off speed-of-response to improve stability.
In practice, it has been found that there is little to choose between LAND and STATIC modes for most stationary Timing applications, and the default setting is therefore to Land mode.
Land mode is also suitable for use at sea on a wide range of surface vessels where maximum accelerations are limited.

If the SEA mode is selected, the GPS receiver operates in 2D-Auto state where the GPS Height parameter is not calculated, the height value used being that last calculated when in 3D mode.
Therefore, if SEA mode is used, it is advisable to select it only *after* the unit has been operating on board the vessel for a period so that its Height parameter is already established and close to MSL.
In general it may be said that Land mode is the best choice for Timing applications primarily on the grounds of operating convenience.

The current GPS WEEK Number is also shown in the lower-left field as a 4-digit Hexadecimal number

Description, VERSN *Page*

This page shows the2804 unit's type number and the software version that is fitted to it.

FRONT PANEL LED INDICATORS

In addition to the main alphanumeric display window, the 2804A has a group of seven discrete LED indicators that are located to the left of the front panel.
These provide an independent monitoring facility giving an immediate indication of the units' operational state, without the necessity to read the main display or to operate the buttons.

The indicators have the following legends and colour.
[Colour-use philosophy is: Green for OK, Amber for Information, Red for Warning]

POWER	ac	green	ALARMS	System Reset	red
	dc	green		Display	red
				BIT	red

MODEM OUTPUT INACTIVE amber PANEL LOCK amber

POWER ac The ac power indicator is lit when the associated supply is connected and the rear-panel switch is in the 'on' position.

dc When a 24V dc source is connected, this indicator will be lit; there is no dc on/off switch.
The dc supply input is an optional-use power-support feature that may not be utilised in the initial application.

ALARMS System Reset This indicator will be illuminated if the processor hardware watchdog has detected an anomaly and has reset the processor to its default states. This function is separate to those provided by the software-controlled BIT system.

Display This indicator will be lit if the display hardware monitor has detected a fault in the display system. Like the Reset indicator above, its function is separate to those provided by the BIT system.
It is provided to allow distinction between a 'blank display' due to the auto shut-off timeout, and a total failure of the display.

BIT The BIT indicator LED will be illuminated when the BIT system has detected a fault, and provides an alerting indication even when the main display window is not illuminated.

MODEM OUTPUT INACTIVE This indicator shows that there is no output from the Modem interface. This is not necessarily a fault condition, since a command exists to inhibit this output if required during system testing or maintenance. Hence, the indicator is classed as advisory.

PANEL LOCK This indicator will be lit when the Panel Lock (anti-tamper) function is set to the 'locked' state. It serves to indicate this state even when the display window has been blanked by the auto shut-off timeout feature.

THE CONTROL & MONITORING PORTS

J6, Com-1 Port and J5, Com-2 Port -- Connectivity

These two RS232 serial interfaces are connected via 9-way 'D' type sockets (DE9S), J5 and J6 on the units rear panel.

Pin designations are shown below and in Drg. No. 2840-4228.
Output signal levels and input signal specifications are in accordance with EIA-RS232C.

Pin No		Function
1	-	Chassis (Protective Ground)
2	-	SDI ----- Serial Data - INPUT
3	-	SDO --- Serial Data - OUTPUT
4	-	DTR --- Data Terminal Ready - OUTPUT
5	-	Signal Ground
6		DO NOT CONNECT
7	-	RTS --- Ready to Send - OUTPUT
8	-	CTS --- Clear to Send - INPUT
9		DO NOT CONNECT

Serial communication parameters may be set via the front panel **(SET Menu, SER-1 Page)**
Different settings are allowed for each port, the options being as listed below

Data format	-	8 bits or 7 bits
Baud Rate	-	9600, 4800, 2400, or 1200 Bd
Stop-Bit Length	-	1 bit or 2 bits
Parity	-	Odd or Even Parity or No parity bit

Factory default settings are **9600Bd, 8Data, 1Stop, No parity** ***for both ports***

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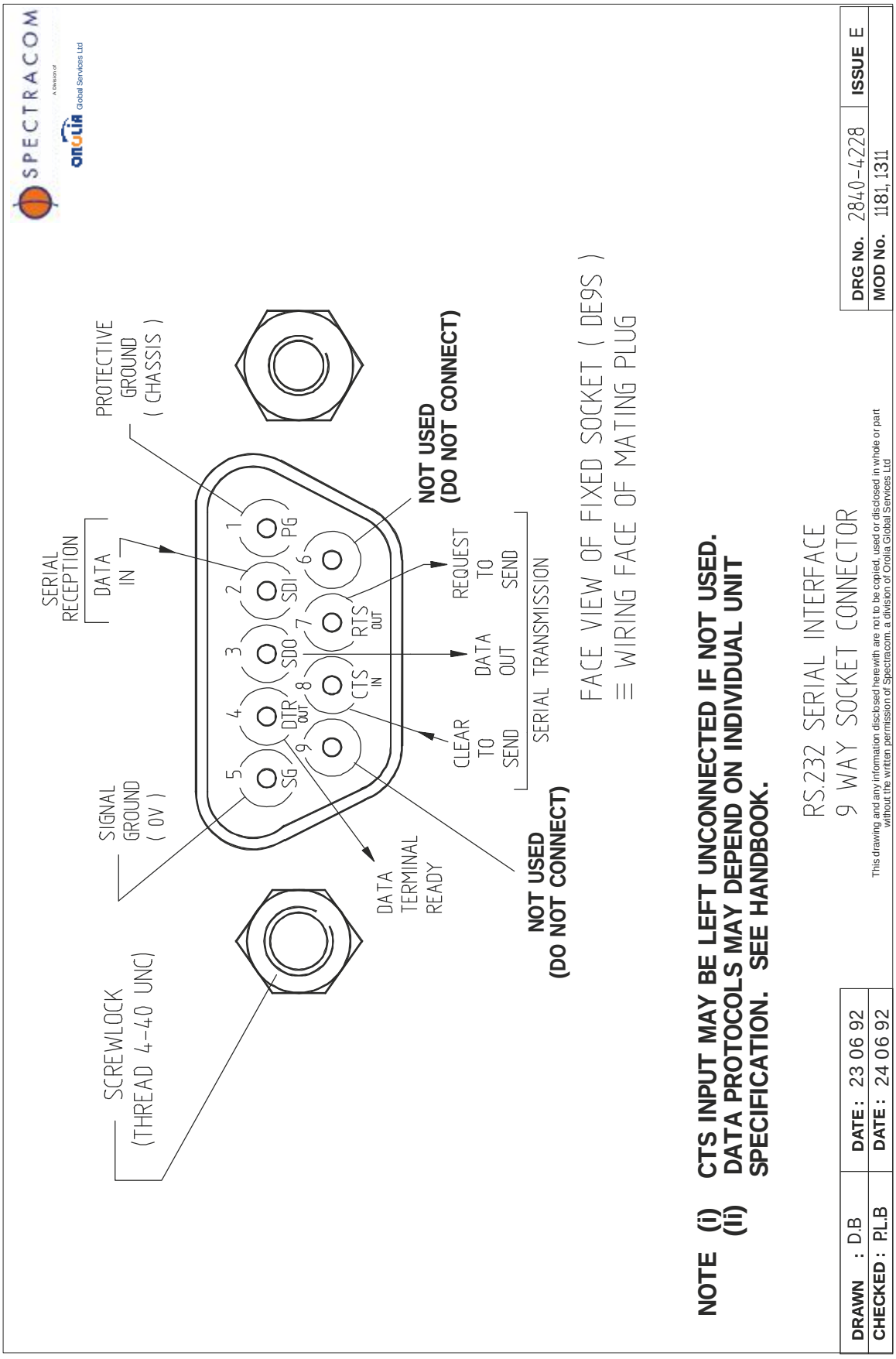
Drg. No. 2840-4228 -- Serial (RS232) Connectors

/ USED AT COM PORT 1 AND COM PORT 2



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Com Port operating modes

Each COM port can operate in two distinct modes, these are referred to as Stream and Remote.

Because the ports port operate independently from one another, one can be set for Stream mode when the other is in Remote mode, if this is required.

The behaviour in each mode is described below

(i) ***STREAM*** - [sometimes described as 'broadcast']

The port will output a continual fixed-format sequence of data from the 2804 that can be displayed on a 'dumb' terminal or a PC running a Terminal-emulator programme.
This is often useful for evaluation and confidence-checking of the unit's operation.
In this mode only 3 commands are accepted, which are

<Control>S stop display scroll ('software handshake' ASCII DC3)

<Control>Q start display scroll ('software handshake' ASCII DC1)

? change serial mode (to REMOTE)

No delimiters are necessary with these commands.
Any other command will be ignored when operating in the Stream mode

(ii) ***REMOTE***

In this mode the port accepts a number of remote control commands allowing setting and interrogation of the unit. See detailed listing and description of available commands in subsequent sections

The ? command remains available to allow a return to the Stream mode if required.

The <CR> delimiter is required on all commands except ?

<CR><LF> will be sent following all response packets

Errors will invoke a defined error message, ER1, ER2, etc

There is negligible change in the turn-around response time if both ports are interrogated simultaneously when they are both operating in the Remote mode.

NOTE: The unit will power-up (or reset) with each port set to the Stream or Remote mode as previously set by the user. See the later section on the Set Configuration command.

Stream Mode -- fixed-format output

The data transmitted in the STREAM mode allows the display of date/time and position messages on a 'dumb' RS232 terminal, or a PC using a Terminal Emulator programme.
See below for example of format.

ASCII character strings are transmitted as follows:

At every second -- a Time-Date message,
Every 10 seconds -- a Position and Satellite-data message

Example:

		See notes:
UTC Time	: 10:33:41 26/06/97	(i)
UTC Time	: 10:33:42 26/06/97	
UTC Time	: etc., etc.	
UTC Time	: 10:33:49 26/06/97	
UTC Time	: 10:33:50 26/06/97	
Position	: 51 16.425 N 001 06.040 W 0107M	(ii)
PDOP	: 06	(iii)
Sat PRN	: 03,12,20,24,25,30	(iv)
Sat level	: 09,11,24,12,15,22	(v)
Fix, Mode	: 3D , Control	(vi)
UTC Time	: 10:33:51 26/06/97	
UTC Time	: 10:33:52 26/06/97	
UTC Time	: 10:33:53 26/06/97	
UTC Time	: 10:33:54 26/06/97	
UTC Time	: etc.	

User-selectable options are available to omit the Satellite data packets and/or to display Time/Date from the LOCAL rather than the UTC timescale.
See sections on Manual operations or serial COM-port commands.

Notes:--

(i) If the unit is operating in the GPS timing mode, the prefix **UTC** will be replaced by the prefix **GPS**. See CONTROL COMMAND section for definition of UTC and GPS time.

(ii) '**Position**' is shown as <Latitude><Longitude><Height>
Latitude being xx yy.abcN
Longitude being xxx yy.abcW
Height xyzM
Where xxx = degrees, and yy.abc= minutes of arc.(three decimal places)
N = North, S = South, E = East, W = West.
Height is in Metres above WGS-84 m.s.l.

(iii) '**PDOP**' is the current Position Dilution of Precision statistic. In normal operation this should be 06 or less; note that lower is better, 01 is best available. If receiver is not doing fixes then 00 will be shown.

(iv) '**Sat PRN**' These are the identity codes of currently visible satellites according to the GPS almanac

(v) '**Sat level**' These are the signal level indications from the receiver for the satellites identified above in the PRN list, they will vary with time and site conditions (in the range 00 to over 30). The signal levels shown are on an arbitrary scale, not a dB scale and are valid only when the receiver is showing a 1D, 2D, or 3D fix, see (vi) below**.**

(vi) '**Fix**' indicates the current status of the GPS receiver where 1D shows it working in the single-satellite (time only) operation whilst 2D or 3D show, respectively, 3 or 4 satellite (time and position) working.

'**Mode**' indicates the status of the units' frequency reference drift-correction system, this may be in the 'Inactive' or in the 'Control' state.

Remote Mode Command Set

The command format used on the serial RS232 control ports is:

[ASCII letter character/s] [byte string (parameter)] [delimiter]

Note:
Command identity letter/s may be in upper case or lower case.
The parameter string is required only on certain commands.
The standard delimiter character is Carriage Return (ASCII 0DH).
Line Feed (ASCII 0AH) characters are ignored; ie. CR LF is OK.
Spaces and punctuation characters are illegal.

In general, commands that load data into the unit or initiate specific actions are designated **Set** commands. These have identities starting with the character **S**.

Commands that interrogate the unit without initiating any further action are designated **Read** commands and have identities beginning with **R**.
Other commands associated with maintenance etc. may use other identity letters.

Command responses will be prefixed by the command identity.
Response delimiters will be 'Carriage Return' and 'Line Feed'. Shown below as <CR><LF>.

Under error conditions, the normal response will be replaced by ER1 etc., depending on the nature of the error.

ER1	Command not recognised.
ER2	Command parameter error.
ER3	Command not accepted.

Command Summary

The following standard commands are recognised in the REMOTE mode.

(**i) Interrogation Commands**

These Commands are used to read information from the unit on a routine basis; they do not affect the normal operation of the unit.

Format		Command Name
RCM	<CR>	Read Current Mode and Status
REG	<CR>	Read Elapsed GPS-on time
REP	<CR>	Read Elapsed Power-on time
RET	<CR>	Read Event Time
RFS	<CR>	Read Frequency State
RGL	<CR>	Read GPS Levels
RGN	<CR>	Read GPS PRN's
RGP	<CR>	Read GPS Position
RGS	<CR>	Read GPS Status
RGV	<CR>	Read GPS Velocity
RH1	<CR>	Read Frequency History 1
RH2	<CR>	Read Frequency History 2
RIT	<CR>	Read Internal Temperature
RLF	<CR>	Read Last Fault(s)
RLT	<CR>	Read Local Time
RNL	<CR>	Read Next Local Time
RNU	<CR>	Read Next UTC Time
RSV	<CR>	Read Software Version
RVA	<CR>	Read Voltage A (Main Power)
RVB	<CR>	Read Voltage B (Standby Power)
RVC	<CR>	Read Voltage C (Oscillator supply)
RVD	<CR>	Read Voltage D (Logic supply)
RVE	<CR>	Read Voltage E (+12V supply)
RVF	<CR>	Read Voltage F (-12V supply)
RVG	<CR>	Read Voltage G (Oscillator reference)
RVH	<CR>	Read Voltage H (Oscillator control)
RVI	<CR>	Read Voltage I (Rubidium crystal)
RVJ	<CR>	Read Voltage J (Rubidium lamp)

(ii) Control & Configuration Commands

These are commands used to set-up the operating mode of the unit according to requirements. Care should be exercised when using any 'Set' commands, particularly where the unit is operational in a performance-critical situation.

Format		Command Name
RAD	<CR>	Read Alarm Delays
SADabcd	<CR>	Set Alarm Delays
RCB	<CR>	Read Control Bits (IRIG Timecode)
SCBaaaaaa	<CR>	Set Control Bits (IRIG Timecode)
RDS	<CR>	Read Daylight Saving Time Parameters
SDSmsddmmyyyyeennzzzz	<CR>	Set Daylight Saving Time
REO	<CR>	Read Event Origin
SEOa	<CR>	Set Event Origin
RFD	<CR>	Read Frequency Divisor
SFDa	<CR>	Set Frequency Divisor
RFM	<CR>	Read Fault Mask
SFMa	<CR>	Set Fault Mask
RGM	<CR>	Read GPS Mode
SGMa	<CR>	Set GPS Mode
RGW	<CR>	Read Week Number
SGWwwww	<CR>	Set GPS Week Number
RLS	<CR>	Read Leap Second data
SLSm	<CR>	Set Leap Second Mode
ROV	<CR>	Read Oscillator Voltage
SOVvvvv	<CR>	Set Oscillator Voltage
RPC	<CR>	Read ppS Configuration
SPCab	<CR>	Set ppS Configuration
SPLa	<CR>	Set Panel Lock
RRD	<CR>	Read Remote Display Configuration
SRDa	<CR>	Set Remote Display Configuration
RS1	<CR>	Read Serial 1 Configuration
SS1abc	<CR>	Set Serial 1 Configuration
RS2	<CR>	Read Serial 2 Configuration
SS2abc	<CR>	Set Serial 2 Configuration
RSF	<CR>	Read Synthesiser Frequency
SSFaaaaaaaaaa	<CR>	Set Synthesiser Frequency
RTC	<CR>	Read Timecode Configuration
STCa	<CR>	Set Timecode Configuration
RTD	<CR>	Read Timing Delay
STDaa	<CR>	Set Timing Delay
RTZ	<CR>	Read Time Zone
STZshhmm	<CR>	Set Time Zone (Local Offset)
RUT	<CR>	Read UTC Time
SUTyyyymmddwhhmmss	<CR>	Set UTC Time
SGTa	<CR>	Set GPS Time Inhibit
SVLa	<CR>	Set Voltage Lock
Wabcdef	<CR>	Wrap Interface test command
?	(no delimiter)	Change Interface Mode
#	(no delimiter)	Serial Event
@B	<CR>	Read LPFRS Bias
@Baa	<CR>	Set LPFRS Bias
@G	<CR>	Reset GPS Reciever
@H	<CR>	Read Hardware Configuration
@Habccdddd	<CR>	Set Hardware configuration
@T	<CR>	Start Tests

@Z	<CR>	Reset

2804A COMMAND AND RESPONSE DETAIL.

RAD<CR> Read Alarm Delays

Response RADabcd<CR><LF>

Where a is the Relay GPS delay
b is the Relay control delay
c is the Auxiliary GPS delay
d is the Auxiliary control delay
and a,b,c,d are hexadecimal values coded as follows

- '0' = 1 second delay
- '1' = 2 second delay
- '2' = 5 second delay
- '3' = 10 second delay
- '4' = 20 second delay
- '5' = 50 second delay
- '6' = 100 second delay
- '7' = 200 second delay
- '8' = 500 second delay
- '9' = 1000 second delay
- 'A' = 2000 second delay
- 'B' = 5000 second delay
- 'C' = 10000 second delay
- 'D' = 20000 second delay
- 'E' = 50000 second delay
- 'F'= 65000 second delay

RCB<CR> Read Control Bits (IRIG Timecode)

Response RCBabcdef<CR><LF>

Where abcdef is a six digit hexadecimal number that is coded into the allocated control bit area of the IRIG timecode frame (index 50-78 inc.). Note IRIG code index positions 54,64 and 74 are coded as 0. Also data in the IRIG frame is coded LSB first so that 'f' bit 0 is index 50 and 'a' bit 3 is index 78

RCM<CR> Read Current Mode and Status

Response RCMabcdefghijk<CR><LF>

Where abcdefghijk is a 11 digit hex value whose bits relate to the current mode and status

a bit 3 = Relay alarm output state – 0 = relay off (alarm) ; 1 = relay on
a bit 2 = Auxiliary alarm state – 0 = aux. alarm o/p high ; 1 = aux. alarm o/p low
a bit 1 = 0 - not used
a bit 0 = Fault status – 1 = Fault

b bit 3 = Main Power input fault – 1 = fault
b bit 2 = Standby Power input fault – 1 = fault
b bit 1 = Oscillator Supply fault – 1 = fault
b bit 0 = Over temperature – 1 = fault (>76.7°C)

c bit 3 = +12 volt supply fault – 1 = fault
c bit 2 = -12 volt supply fault – 1 = fault
c bit 1 = Oscillator Reference fault – 1 = fault
c bit 0 = DAC output fault – 1 = fault

d bit 3 = Rubidium Comms fault – 1 = fault (LPFRS only)
d bit 2 = Rubidium Limit fault – 1 = fault
d bit 1 = Rubidium Lock fault – 1 = fault
d bit 0 = ADC Error – 1 = fault

e bit 3 = 10MHz clock fault – 1 = fault
e bit 2 = 1Hz clock fault – 1 = fault
e bit 1 = Rubidium crystal voltage fault – 1 = fault
e bit 0 = Rubidium lamp voltage fault – 1 = fault

f bit 3 = GPS receiver comms fault – 1 = fault
f bit 2 = GPS receiver antenna status – 1 = antenna open or short
f bit 1 = GPS receiver navigating status – 1 = navigating
f bit 0 = GPS receiver time update inhibit status – 1 = inhibit

g bit 3 = GPS receiver 1ppS timeout fault – 1 = fault
g bit 2 = 0 - Not used
g bit 1 = 0 - Not used
g bit 0 = 0 - Not used

h bit 3 = Time set from GPS – 1 = true
h bit 2 = Time set from Panel – 1 = true
h bit 1 = Time set from Serial – 1 = true
h bit 0 = Time set from RTC – 1 = true

i bit 3 = 0 – not used
i bit 2 = Frequency control – 1 = on
i bit 1 = Frequency control inhibit – 1 = inhibit
i bit 0 = Panel lock status – 1 = locked

j bit 3 = 0 – not used
j bit 2 = RTC fault – 1 = fault
j bit 1 = Non volatile memory fault – 1 = fault
j bit 0 = Display fault – 1 = fault

k bit 3 = Rubidium serial port fault – 1 = fault
k bit 2 = Com 2 serial port fault – 1 = fault
k bit 1 = Com 1 serial port fault – 1 = fault
k bit 0 = GPS serial port fault – 1 = fault

RDS<CR> Read Daylight Saving Time Parameters

Response RDSms,ddmmyyyy,eennzzzz<CR><LF>

Where m = 2 – Automatic mode
m = 1 – Manual mode
m = 0 – Off
s = 2 - +2 hour time shift
s = 1 - +1 hour time shift
ddmmyyyy is the start date of summer (daylight saving) time
eennzzzz is the end date of summer (daylight saving) time

REG<CR> Read Elapsed GPS-on time

Response REGyyyymmddhhmm<CR><LF>

Where yyyymmddhhmm is the year, month, day, hours and minutes of the date and time that the GPS receiver acquired a fix. This indicates the time that the unit has had continuous GPS reception. If the GPS receiver is not doing position fixes when an REG<CR> command is received then an ER3 response is generated.

REO<CR> Read Event Origin

Response REOa<CR><LF>

Where a is a hexadecimal number with bit assignments as follows
a bit 3 = 0 – Not used
a bit 2 = 0 – Not used
a bit 1 = Event time source – 0 = UTC ; 1 = Local
a bit 0 = Event source – 0 = Pulse ; 1 = Serial

REP<CR> Read Elapsed Power-on time

Response REPyyyymmddhhmm<CR><LF>

Where yyyymmddhhmm is the year, month, day, hours and minutes of the date and time that the unit was last reset. A reset will be generated on power up, a reset command from the front panel or interface command (@Z)

RET<CR> Read Event Time

Response RETyyyymmddwhhmmss.ffffff<CR><LF>

Where yyyy = Year (2000 to 2999 decimal)
mm = Month (01 to 12 decimal)
dd = Day of month (01 to 31 decimal)
w = Day of week (0 to 6 decimal – 1=Monday)
hh = Hours (00 to 23 decimal)
mm = Minutes (00 to 59 decimal)
ss.ffffff = Seconds (00.000000 to 59.999999)

N. B. When no event is stored the response ER3<CR><LF> is sent. Reading the event time with this command removes it from the stored event table. The event that is read with this command is the most recent event recorded.

N.B. When the event origin is changed from serial to pulse or from pulse to serial an event may be generated by the change.

RFD<CR> Read Frequency Divisor (Fx output -- J option only)

Response RFDa<CR><LF>

Where a (0 to 7 inc.) represents the frequency outputs as follows
a = 0 – 10 MHz
a = 1 – 5 MHz
a = 2 – 2.5 MHz
a = 3 – 1.25 MHz
a = 4 – 1 MHz
a = 5 – 500 KHz
a = 6 – 200 KHz
a = 7 – 100 KHz

N. B. Where a synthesiser [S option] is fitted, this frequency output is used internally and is set to 1MHz (a=4).

RFM<CR> Read Fault Mask

Response RFMa<CR><LF>

Where a has the fault mask with bit assignments as follows
a bits 3,2 – not used
a bit 1 = AC power low – 1 = masked
a bit 0 = DC power low – 1 = masked

RFS<CR> Read Frequency State

Response RFSannnn,cccc<CR><LF>

Where a = control index 0-8 inc.
nnnn = last DAC change (hexadecimal)
cccc = control count (hexadecimal) 0000-7FFF

RGL<CR> Read GPS Levels

Response RGLdd,dd,dd,dd,dd,dd,dd,dd<CR><LF>

Where dd is the relative signal level for the satellite shown in the RGN response
N.B. This is a variable length string that is dependant on the number of satellites acquired or being searched for by the GPS receiver. There will be a maximum of 8 data values and a minimum of 0 data values. The data is updated every 10 seconds.

RGM<CR> Read GPS Mode

Response RGMa<CR><LF>

Where a denotes the GPS receiver mode
a = 0 – Land (default)
a = 1 – Sea
a = 2 – Air
a = 3 – Static

RGN<CR> Read GPS PRN's

Response RGNpp,pp,pp,pp,pp,pp,pp,pp<CR><LF>

Where pp are the satellite PRN
N.B. This is a variable length string that is dependant on the number of satellites acquired or being searched for by the GPS receiver. There will be a maximum of 8 data values and a minimum of 0 data values. The data is updated every 10 seconds.

RGP<CR> Read GPS Position

Response RGPaabb.bbbcdddee.eeefhhhhPnn<CR><LF>

Where aa = latitude degrees (00 to 89 decimal)
bb.bbb = latitude minutes (00.000 to 59.999 decimal)
c = latitude hemisphere (N or S)
dd = longitude degrees (00 to 89 decimal)
ee.eee = longitude minutes (00.000 to 59.999 decimal)
f = longitude hemisphere (E or W)
hhhh = height in metres (0000 to 9999 decimal)
P = separator (P)
nn = PDOP (00 to 99 decimal)

RGS<CR> Read GPS Status

Response RGSabcdefgh<CR><LF>

Where abcdefgh is an 8 digit hexadecimal number bit assignments/values as follows

a = 0 not used
b = 0 – Doing position fixes
b = 1 – No GPS time
b = 2 – Initialisation fault
b = 3 – PDOP too high
b = 8 – No usable satellites
b = 9 – Only one usable satellite
b = A – Only two usable satellite
b = B – Only three usable satellite
b = C – The chosen satellite is unusable
c = 0 – Antenna OK
c = 1 – Antenna line fault (open or short)
d = 0 – Battery supported RAM OK
d = 1 – Battery supported RAM not valid at start-up
ef = Receiver Identity (00 to FF hexadecimal)
g = 0 – Not used
h bit 3 = Stored Almanac Status – 0 = complete and current
h bit 2 = 0 – Not used
h bit 1 = Real time Clock Status – 1 = Not available
h bit 0 = 0 – Not used

RGV<CR> Read GPS Velocity

Response RGVnnnNeeeEuuuU<CR><LF>

Where nnn = North velocity component M/s (000 to 999 decimal)
N = separator (N)
eee = East velocity component M/s (000 to 999 decimal)
E = separator (E)
uuu = Up velocity component M/s (000 to 999 decimal)
U = separator (U)

RGW<CR> Read Week Number

Response RGWwwww<CR><LF>

Where wwww = GPS week number (0000 to FFFF hexadecimal)

RH1<CR> Read Frequency History 1

Response RFH1aaaa,bbbb,cccc,dddd,eeee,ffff,gggg,hhhh<CR><LF>

Where aaaa,bbbb etc. are 4 digit hexadecimal numbers denoting the DAC value. The 8 readings are the last 8 values with aaaa being the most recent (current value) and hhhh being the oldest. The data is set to 0 when the unit is reset.

RH2<CR> Read Frequency History 2

Response

RFH2aaaa,bbbb,cccc,dddd,eeee,ffff,gggg,hhhh,iiii,jjjj,kkkk,llll<CR><LF>

Where aaaa,bbbb etc. are 4 digit hexadecimal numbers denoting the average DAC value of the last 8 values. The 12 readings are the values stored at midnight for the last 12 days with aaaa being the most recent and llll being the oldest. The data is set to 0 when the unit is reset.

RIT<CR> Read Internal Temp

Response RITaa.a<CR><LF>

Where aa.a is the internal temperature of the unit (00.0 to 99.9 °C)

RLF<CR> Read Last Fault(s)

Response RLFabcdefghijk<CR><LF>

Where a is the current alarm status
bcdefghijk is a 10 digit hexadecimal value whose bits relate to the mode and status at the time of the last fault

The data abcdefghijk is identical to that in the RCM command as above.

RLS<CR> Read Leap-Second data

Response RLSyyyymmddoonn,cc,mf<CR><LF>

Where yyyymmdd = Date of next Leap-second [00000000 if none scheduled]
oo = Previous Leap-second offset (00 to FF hexadecimal) [00 if none scheduled]
nn = Next Leap-second offset (00 to FF hexadecimal) [00 if none scheduled]
cc = Current Leap-second offset (00 to FF hexadecimal) [0Dhex=13 secs in Y2002]
m = Mode – 0 = ITU (59,60) ; 1 = non ITU (59,59)
f = 4 means Leap second completed
f = 2 means Leap second active
f = 1 means Leap second pending
f = 0 means Leap second not scheduled
N.B. This data is only valid after receipt from the GPS receiver. This can take up to 15 minutes after a Fix is obtained.

RLT<CR> Read Local Time

Response RLTyyyymmddwbbbhhmmss<CR><LF>

Where yyyymmdd = Date (20000101 to 29991231)
w = Day of week (0 to 6 ; 1 = Monday)
bbb = Day of year (001 to 366 decimal)
hhmmss = Time of day (000000 to 235959)

RNL<CR> Read Next Local Time

Response RNLyyyymmddwbbbhhmmss<CR><LF>

Where the data is the same as the RLT command above

N.B. The response to this command is delayed until the beginning of the second following the receipt of the command. This can result in a delay of up to one second but does allow more accurate timing via the serial interface. If another command is received whilst this response is pending then this response is cancelled and the response to the second command is made.

RNU<CR> Read Next UTC Time

Response RNUyyyymmddwbbbhhmmss<CR><LF>

Where the data format is the same as the RNL command above but the data contains the UTC time. The constraints of the RNL command also apply to this command.

ROV<CR> Read Oscillator Voltage

Response ROVvvvv<CR><LF>

Where vvvv is a four digit hexadecimal number 0000 to FFFF representing the current DAC value

RPC<CR> Read ppS Configuration

Response RPCab<CR><LF>

Where ab is a 2 digit hexadecimal number with bit assignments as follows
a bit 3 = 0 – Not used
a bit 2 = 0 – Not used
a bit 1 = Timing Pulse A Length 0 = 500mS ; 1 = 100uS
a bit 0 = Timing Pulse A Mode 0 = Gated ; 1 = Continuous
b bit 3 = 0 – Not used
b bit 2 = 0 – Not used
b bit 1 = Timing Pulse B Length 0 = 500mS ; 1 = 100uS
b bit 0 = Timing Pulse B Mode 0 = Gated ; 1 = Continuous

RRD<CR> Read Remote Display Configuration

Response RRDa<CR><LF>

Where a is a hexadecimal number with bit assignments as follows
a bit 3 = 0 – Not used
a bit 2 = Time select – 0 = UTC ; 1 = Local
a bit 1 = 0 – Not used
a bit 0 = Type select – 0 = Spectracom ; 1 = LEC

RS1<CR> Read Serial 1 Configuration

Response RS1abc<CR><LF>

Where abc is a 3 digit hexadecimal number with bit assignments as follows
a bit 3 = 0 – Not used
a bit 2 = Baud rate msb
a bit 1 = Baud rate lsb
a bit 0 = Parity type – 0 = Odd ; 1 = Even
b bit 3 = Parity state – 0 = Disabled ; 1 = Enabled
b bit 2 = Number of stop bits – 0 = 1 stop bit ; 1 = 2 stop bits
b bit 1 = 1 – Not used
b bit 0 = Number of data bits – 0 = 7 data bits ; 1 = 8 data bits
c bit 3 = 0 – Not used
c bit 2 = Mode – 0 = Remote ; 1 = Stream
c bit 1 = Stream mode time select – 0 = UTC ; 1 = Local
c bit 0 = Stream mode data – 0 = Time + status – 1 = Time only

Baud rate 00 = 1200 baud ; 01 = 2400 baud ; 10 = 4800 baud ; 11 = 9600 baud

N.B. – The stream mode time select and data bits are common to both serial 1 and serial 2 interfaces.

RS2<CR> Read Serial 2 Configuration

Response RS2abc<CR><LF>

Where abc is a 3 digit hexadecimal number with bit assignments as described above for Serial 1 port

RSF<CR> Read Synthesiser Frequency

Response RSFaaaaaaaaaa<CR><LF>

Where aaaaaaaaaa is a 10 digit decimal number representing the current synthesiser frequency with a resolution of .01 Hz.

RSV<CR> Read Software Version

Response RSVaaaaaaaa,nn.nn;ss.ss<CR><LF>

Where aaaaaaaa is an alphanumeric string denoting the 2804 s/w
nn.nn is the GPS receiver main s/w
ss.ss is the GPS receiver DSP s/w

RTC<CR> Read Timecode Configuration

Response RTCab<CR><LF>

Where a = Time source – 0 = GPS ; 1 = Local
b = 4 – SMPTE
b = 3 – IRIG A
b = 2 – XR3 2137 (1KHz)
b = 1 – IRIG B
b = 0 – XR3 (250 Hz)

RTD<CR> Read Timing Delay

Response RTDaa<CR><LF>

Where aa is a 2 digit hexadecimal number denoting the timing delay
The value (0 to 255) represents the delay in 25nS units with the nominal value of 80H (128) for 0 delay giving a total delay variation of ±3125nS.

RTZ<CR> Read Time Zone
Response RTZshhmm<CR><LF>
Where shhmm is the time offset between UTC and local time
s = sign digit (‘+’ or ‘-‘)
hh = Hours (00 to 23 decimal)
mm = Minutes (00 to 59 decimal)

RUT<CR> Read UTC Time
Response RUTyyyymmddwbbbhhmmss<CR><LF>
Where the data structure is the same as described for the RLT command above.

RVA<CR> Read Voltage A (Main power)
Response RVAxx.x<CR><LF>
Where xx.x is the main power voltage (unregulated)

RVB<CR> Read Voltage B (Standby power)
Response RVBxx.x<CR><LF>
Where xx.x is the standby power voltage

RVC<CR> Read Voltage C (Oscillator supply)
Response RVCxx.x<CR><LF>
Where xx.x is the oscillator supply voltage

RVD<CR> Read Voltage D (Logic supply)
Response RVDx.xx<CR><LF>
Where x.xx is the logic supply voltage

RVE<CR> Read Voltage E (+12V supply)
Response RVExx.x<CR><LF>
Where xx.x is the +12V nominal supply voltage

RVF<CR> Read Voltage F (-12V supply)
Response RVFxx.x<CR><LF>
Where x.xx is the –12V nominal supply voltage

RVG<CR> Read Voltage G (Osc reference)
Response RVGx.xx<CR><LF>
Where x.xx is the oscillator reference voltage

RVH<CR> Read Voltage H (Oscillator control)
Response RVHx.xx<CR><LF>
Where x.xx is the oscillator control voltage

RVI<CR> Read Voltage I (Rubidium crystal)
Response RVIxx.x<CR><LF>
Where xx.x is the rubidium crystal voltage
N.B. When a rubidium oscillator is not fitted the response is replaced by ER3<CR><LF>

RVJ<CR> Read Voltage J (Rubidium lamp)
Response RVJxx.x<CR><LF>
Where xx.x is the rubidium lamp voltage
N.B. When a rubidium oscillator is not fitted the response is replaced by ER3<CR><LF>

SADabcd<CR> Set Alarm Delays

Response SADabcd<CR><LF>

Where abcd (4 digit hexadecimal) represent the alarm delays as described for the RAD command above

The delay settings are stored in non-volatile memory.

SCBaaaaaa<CR> Set Control Bits

Response SCBaaaaaa <CR><LF>

Where aaaaaa (6 digit hexadecimal) are the control bits inserted into the IRIG timecode as described for the RCB command above

The control bits are set to zero when the unit is reset

SDSmsddmmyyyyeennzzzz<CR> Set Daylight Saving Time

Response SDSmsddmmyyyyeennzzzz <CR><LF>

Where msddmmyyyyeennzzzz represents the daylight saving (summer) time parameters as described for the RDS command above. When setting the mode to off or automatic, valid dates must be entered although these will not be used.

The daylight saving parameters are stored in non-volatile memory

SEOa<CR> Set Event Origin

Response SEOa <CR><LF>

Where a is a hexadecimal number with bit assignments as described for the REO command above

The event origin is stored in non-volatile memory

SFDa<CR> Set Frequency Divisor

Response SFDa <CR><LF>

Where a is a hexadecimal number with bit assignments as described for the RFD command above

N.B. When the synthesiser option is fitted, this frequency output is used internally and is preset.to 4 (1MHz) thus any SFDa command will elicit an ER3 error response.

The frequency divisor is stored in non-volatile memory

SFMa<CR> Set Fault Mask

Response SFMa<CR><LF>

Where a is a hexadecimal number with bit assignments as described for the RFM command above

The fault mask is stored in non-volatile memory

SGMa<CR> Set GPS Mode

Response SGMa<CR><LF>

Where a is a hexadecimal number with bit assignments as described for the RGM command above

The gps mode is stored in non-volatile memory

SGTa<CR> Set GPS Time Inhibit

Response SGTa<CR><LF>

Where a = 1 Inhibit GPS time updates (allow SUT command when GPS on)

a = 0 Enable GPS time updates

N.B. The state of this bit can be read via the RCM command

This bit is set to zero when the unit is reset

SGWwwww<CR> Set Week Number

Response SGWwwww<CR><LF>

Where wwww (4 digit hexadecimal 0000 to 1FFF) represent the GPS week number as described for the RGW command above

SLSm<CR> Set Leap Second Mode

Response SLSm <CR><LF>
m = Mode – 0 = ITU (59,60) ; 1 = non ITU (59,59)
N.B. restrictions apply to the date set via this command and it will be overwritten by the GPS received data
Only the mode is stored in non-volatile memory

SOVvvvv<CR> Set Oscillator Voltage

Response SOVvvvv <CR><LF>
Where vvvv (4 digit hexadecimal) is the DAC value which sets the oscillator voltage and thus controls the oscillator frequency. This value is automatically adjusted when the GPS receiver is operating.
N. B. In order for this command to be executed, either the GPS receiver must be inoperative OR the GPS correction must be inhibited via the SVL command above. If the command is not accepted then an ER3 response is given.
The oscillator voltage is stored in non-volatile memory

SPCab<CR> Set ppS Configuration

Response SPCab <CR><LF>
Where ab is a hexadecimal number with bit assignments as described for the RPC command above
The ppS configuration is stored in non-volatile memory

SPLa<CR> Set Panel Lock

Response SPLa<CR><LF>
Where a = 1 - Lock panel (disable setting from the front panel switches)
a = 0 – Unlock panel (enable setting from the front panel)
N.B. The state of this bit can be read via the RCM command
This bit is set to zero when the unit is reset

SRDa<CR> Set Remote Display Configuration

Response SRDa<CR><LF>
Where a is a hexadecimal number with bit assignments as described for the RRD command above
The remote display configuration is stored in non-volatile memory

SS1abc<CR> Set Serial 1 Configuration

Response SS1abc<CR><LF>
Where abc is a hexadecimal number with bit assignments as described for the RS1 command above
N.B. When changing the configuration for the port that issued the command, the response will be sent in the original configuration and the settings will not be changed until the interface is inactive. So to ensure that the command is implemented, a short period of inactivity should be allowed for after the receipt of the command response.
The serial 1 configuration is stored in non-volatile memory

SS2abc<CR> Set Serial 2 Configuration

Response SS2abc<CR><LF>
Where abc is a hexadecimal number with bit assignments as described for the RS1 command above
N.B. When changing the configuration for the port that issued the command, the response will be sent in the original configuration and the settings will not be changed until the interface is inactive. So to ensure that the command is implemented, a short period of inactivity should be allowed for after the receipt of the command response.
The serial 2 configuration is stored in non-volatile memory

SSFaaaaaaaaaa<CR> Set Synthesiser Frequency

Response SSFaaaaaaaaaa <CR><LF>

Where aaaaaaaaaa is a 10 digit decimal number representing the current synthesiser frequency with a resolution of .01 Hz.

N.B. THE DATA ENTRY IS LIMITED IN THE RANGE 0000000000 TO 1299999999. WITH STANDARD FILTER SETTINGS IN THE SYNTHESISER MODULE, THE FREQUENCY RANGE IS LIMITED TO 11MHZ +1-3DBM (13MHZ +1/-6DBM)

The synthesiser frequency is stored in non-volatile memory

STCa<CR> Set Timecode Configuration

Response STCa<CR><LF>

Where a is a hexadecimal number with bit assignments as described for the RTC command above

The Timecode configuration is stored in non-volatile memory

STDaa<CR> Set Timing Delay

Response STDaa<CR><LF>

Where aa is a hexadecimal number representing the timing delay parameter as described for the RTD command above

The timing delay is stored in non-volatile memory

STZshhmm<CR> Set Time Zone (Local Offset)

Response STZshhmm <CR><LF>

Where shhmm represents the time zone offset as described for the RTZ command above

The time zone offset is stored in non-volatile memory

SUTyyyymmddwhhmmss<CR> Set UTC Time

Response SUTyyyymmddwhhmmss <CR><LF>

Where yyyymmddwhhmmss is the date and time to be set. The data structure is the same as described for the RLT command above.

N. B. In order for this command to be executed, either the GPS receiver must be inoperative OR the GPS time update must be inhibited via the SGT command above. If the command is not accepted then an ER3 response is given.

SVLa<CR> Set Voltage Lock

Response SVLa <CR><LF>

Where a = 1 Lock the control voltage (disable frequency corrections from GPS)

a = 0 Normal (frequency corrections from GPS enabled)

N.B. The state of this bit can be read via the RCM command

This bit is set to zero when the unit is reset

Wabcdef<CR> Wrap interface test command

Response abcdef<CR><LF>

Where abcdef is an alphanumeric string

This command echoes the input data omitting the leading W character

? no delimiter reqd Change interface mode

Response NONE

This command changes the mode of the interface from Stream to Remote or vice-versa. The command does not affect the other port : Changes to the other port configuration can be made via the SS1 or SS2 command as above.

no delimiter reqd Serial Event

Response NONE

This command will cause a serial event to be recorded when the serial event mode is selected (see SEO and REO commands above). This character can occur at any time and is ignored by the command interpreter.

@B<CR> Read LPFRS bias

Response @Baa<CR><LF>

Where aa is a 2 digit hexadecimal number denoting the current bias set in the LPFRS oscillator

The value (0 to 255) represents the bias in 1x10-9 units with the nominal value of 80H (128) for 0 offset.

This command will give the error response ER3 if an LPFRS oscillator is not fitted.

@Baa<CR> Set LPFRS bias

Response @Baa<CR><LF>

Where aa is the bias to be set in the LPFRS oscillator

This command will give the error response ER3 if an LPFRS oscillator is not fitted or if GPS control is active.

N. B. This command will cause large frequency changes in the oscillator and should only be used for test and calibration purposes.

@G<CR> Reset GPS receiver

Response @G<CR><LF>

This command will re initialise the GPS receiver. This may be necessary after a prolonged period of operation without an antenna and avoids having to reset the 2804

@H<CR> Read Hardware configuration

Response @Habccdddd<CR><LF>

Where a = 3 – Rubidium Oscillator Type LPFRS
a = 2 – Rubidium Oscillator Type LPRO
a = 1 – Crystal Oscillator Type 760/660
a = 0 – Crystal Oscillator Type 360
b bit 3 = 0 – Not used
b bit 2 = Timecode 1 type – 0 = IRIG/XR3 ; 1 = SMPTE
b bit 1 = Synthesiser – 0 = Not fitted ; 1 = Fitted
b bit 0 = DC Support Voltage – 0 = 24V ; 1 = 12V
cc is the control loop gain (2 digit hexadecimal)
dddd is the 4 digit alphanumeric string denoting the unit type

@Habccdddd<CR> Set Hardware configuration

Response @Habccdddd<CR><LF>

Where abccdddd are as described above for the read command. Any alteration to these parameters can seriously affect the operation of the unit.

@T<CR> Start tests

Response NONE

This command enables the display test, which is performed at power up, to be repeated. The result of the test can be read using the RCM command as detailed above.

This command also turns on the alarms for a period of 10 seconds.

@Z<CR> Reset

Response NONE

This command performs a software reset on the unit.

No response to the command is generated.

No commands should be sent to the unit for a period of 2 seconds following a system reset to allow for initialisation.

INPUTS & OUTPUTS -- Rear Panel functionality

The following list shows all the rear panel connectors that are fitted as standard on the 2804A. In this list, they are dealt with in numerical order,
Where options are fitted, there may be additional connectors, but these are allocated J-number identities that do not conflict with the standard set.
The standard 2804A has some hole locations (for certain simple options) that are marked, but not populated; These are fitted with blanking plugs, but are included in the list below for completeness.
Connectors are not necessarily arranged in left-to-right order viewing from the rear of the unit, due to the necessity to deal with option numbering;. for the same reason some numbers may be missing from the numerical sequence.

J1 -- 230V 50Hz 60VA Type: IEC

This is the a.c. primary power input. See SPECIFICATION section of this Manual for voltage range etc.

J2 -- 24V d.c. in Type: profDIN7

This is the d.c. support power input. See SPECIFICATION section of this Manual for voltage range etc.
Compatible with Spectracom Battery support units such as the 1811B6. Suitable connection cables are supplied with these units
May also be used as the sole power source input for mobile or similar applications.
Providing that the d.c. supply is of adequate quality, the unit's performance will be unchanged when compared with a.c. operation.

J3 -- d.c. output Type: profDIN8

This is the power output port for connection to a Spectracom 18xx series ACU/Distribution unit.
The 18xx series are used to expand the Timing and Frequency output connectivity of the basic unit and/or provide automatic switching between two sources in applications demanding such facilities.
There is no other specified application for the J3 connector.
Connection to any other type or make of equipment would be ill-advised without consultation with Spectracom, and would in any case be at the users risk.

J4 -- GPS Antenna Type: N

This is the GPS L1 frequency input to the GPS receiver in the 2804A. In addition, it is the d.c. output feed to the LNA in the Antenna head, that requires a nominal +5V supply, supplied via the r.f. downlead.
It is recommended that connections to this port should, if possible, be made with the 2804A unit switched off.
If this is not practical, or is very inconvenient, then take care not to short the centre conductor to ground, and also discharge any cable static by touching the shell of the mating plug onto the case of the 2804A *before* mating the connector.

J5 -- COM Port 2 and J6 -- COM Port 1 Type: 9-way D Sockets

These connectors provide independent control ports having identical capabilities.
The operating mode for each port is user-selectable.
See previous section on Control and Monitoring Ports that includes pin-out and other details
in Drg. No. 2840-4228

J7, J8, J9, J10, J11, J12 -- Reference Frequency Outputs, Sine 50ohm Type: BNC

These connectors provide a +13dBm nominal power level (1V r.m.s. into a 50ohm load).
They are driven by individual linear buffer amplifiers to provide high load isolation.
Output frequency will be 10MHz unless the 5MHz option has been specified. The waveform is essentially sinusoidal if the output is correctly terminated with a 50ohm resistive load.
Output cables of high quality (e.g. RG400 double shielded) are recommended.

J13, J14 -- Timecode Code 2 [option C only, not a standard fit]

These two outputs, designated Code 2 A and Code 2 B respectively, provide identical Timecode formats which may be configured as IRIG-A, IRIG-B, XR3 or 2137. These outputs will drive 50ohm loads.
Unlike the Timecode 1 channels (see below) the Timecode 2 code-type selection is made by internal hardware (circuit jumper) settings that are normally factory-set to user requirements defined at time of order.
Factory (default) set-up is with the A output and the B output as modulated IRIG-B code
There exist internal hardware (circuit jumper) options to switch either or both outputs to non-carrier code sometimes called d.c. code. Consult Factory.

J15, J16 -- Timecode Code 1 Type: BNC

These two outputs, designated Code 1 A and Code 1 B respectively, provide identical Timecode formats which may be user-selected (from panel or Com port) as IRIG-A, IRIG-B, XR3 or 2137. These outputs will drive 50ohm loads.
Factory (default) set-up is with the A output and the B output as modulated IRIG-A code
There exist internal hardware (circuit jumper) options to switch either or both outputs to non-carrier code sometimes called d.c. code. Consult Factory.

J17, J18 -- Timing 1Hz/1pps Type: BNC

These two outputs designated Timing A and Timing B respectively, deliver TTL signals (with 50 ohm drive capability)
The output pulse, occurring once per second, is a rectangular positive pulse which may be user-set to either 500 milliseconds (i.e. a 1Hz squarewave) or a 100 microsecond pulse.
In either case, during operation with normal GPS reception, the leading-edge of the Timing pulse is aligned to UTC within the limits defined in the specification.

J19 -- Alarm (contact) Type: isolated BNC

This isolated relay-contact connection provides the Alarm-1 (Relay) signal to the users monitoring system. Both the shell and centre contact of the connector are isolated from chassis ground. Normal set-up is contacts closed for normal operation.

J20 Type: BNO and J21, J22, J23 Type: BNC [option S only, not a standard fit]

These are the outputs from the Frequency Synthesiser [S option] card and provide the user-selected fsynth frequency at three different signal levels.

J20 is a mini-twinaxial connector delivering RS422 voltage levels.
J21 is a BNC delivering TTL compatible signals.
J22 and J23 are driven from separate linear buffers to provide two +13dBm sine outputs.

J26 -- fx output Type: BNC [option J only, not a standard fit]

This signal is the Fx (user frequency) that may be set to one of a selection of preset values that are produced by integer division from the unit's reference frequency

J27 -- Remote Display Type BNO

Provides an RS422 drive to Spectracom Digital Remote Display units (or to other similar types that are supported).

J28 -- Remote Display [optional second cable driver, not a standard fit]

Provides a second RS422 drive to Spectracom Digital Remote Display units or to other similar types.

J29 -- 1pps input (Event Logging)

Input connector for a TTL event-time marker pulse -- See section on Event Logging

ALARM OUTPUTS

An alarm contact output is presented at connector J19; this is identified as Alarm-1 otherwise referred to as the Relay Alarm and is intended for connection to the user's alarm management system.
The voltage-free alarm relay contacts are factory configured to present as

contacts closed	=	no fault
contacts open	=	fault.

This configuration can be reversed using an internal jumper link, but this is not recommended.
Note that the shell of the alarm contact connector is isolated from chassis (ground).
The relay contacts are wired between the inner contact and shell of the BNC; contact ratings are 30V maxm. open circuit, and 0.5A d.c. maxm. closed-circuit.

The contacts are high quality gold-plated crossbar type, which are suitable for switching low current logic input circuits (recommended current level, 10mA; minimum 1mA).

The contacts will adopt the open-circuit (fault) state if the unit enters an alarm state and will return to the closed (no fault) state when the fault conditions are removed.

Another, separate alarm signal is identified as Alarm-2 otherwise referred to as the Auxiliary Alarm; this is a TTL compatible logic signal which is connected via the dc output connector to provide an alarm state indication to a Spectracom Type 18xx ACU/Distribution unit. This signal is configured as high for fault.

An alarm state will be initiated by the software under any of the conditions listed below:

(i) GPS Receiver is not providing a 2D or 3D fix.
(ii) Oscillator control voltage is outside normal range (even if oscillator is on-frequency)
(iii) Oscillator significantly off-frequency, even if control voltage is normal.
Condition (i) will extinguish the GPS status led and the CONTROL status led
(ii) or (iii) will extinguish the CONTROL status indicator alone.

Any change in status, into or out of a fault condition, will be indicated at the appropriate STATUS light within one second of the units software having detected the change. Any delays programmed into the alarm system will not affect these STATUS indicators.

The system provides for user-selectable time delays between the detection of a failure and the initiation of the output alarm signal and the associated ALARM indicator light.
Separate delays may be applied to GPS status alarms and CONTROL status alarms, and different delay settings may be used for the Alarm-1 (Relay) and Alarm-2 (Aux). channels

Delays values may be set from a minimum of 1 second to a maximum of 65,000 seconds (over 18 hours) using the SAD command that is described in the Command and Response section of this Manual.
The current settings may be read using the RAD command.
The factory (reset/default) setting for all four of the Alarm Delay values is 1 second.

As noted above, any GPS status failure condition will almost immediately cause a CONTROL status failure, since the oscillator-control software can only operate in the presence of a valid GPS reference pulse (1pps). Without it, the oscillator control-voltage is locked to maintain best frequency accuracy.

The alarm logic is configured to distinguish between the situation where a CONTROL status failure occurs due to a GPS failure and the situation where a CONTROL failure occurs in isolation. This feature allows the alarm system to operate due to a GPS failure (the consequent CONTROL failure being ignored) or due to a CONTROL only fault. This is important as regards the setting of the separate alarm-delays, since it allows a more meaningful use to be made of the CONTROL delay setting.

The programmable alarm delay settings are stored in non-volatile memory. They may be programmed as required to suit unusual conditions prevailing at certain sites. Settings should be chosen to reduce the probability of a spurious alarm triggering the users warning system unnecessarily, with the attendant high cost of response.

For example, if a GPS antenna obscuration should occur on a regular basis due to a poor antenna location, or if severe temporary interference should occasionally block reception, then a GPS alarm 'hold-off' may be appropriate.

EVENT LOGGING (Time-Tag) facility

The 2804A will record the time of an external event input from the users system. An event input may be made by a TTL pulse applied at the J29 (1pps input) connector or by sending a unique # (number sign) character, to either of the COM ports.
Each event is recorded as a full Date/Time identity with a digital resolution of 1 microsecond.

The accuracy of the logged data will match this resolution if the event input is made via the rear-panel J29 connector.
If the COM port is used to input the event mark, the accuracy of the logged reading will be compromised by variable serial interface delays resulting in a possible uncertainty of several milliseconds.

The **minimum interval** between events at the J29 pulse input to ensure a correct response is **10milliseconds.**
The minimum recommended pulse length is 5 microseconds.
The leading (positive-going) edge of the pulse is the timing point.

When using the COM port event input, the minimum recommended interval between event mark characters is also 10 millisecond, although in practice is likely to be restricted by serial port delays and transmission times mentioned above.

A total of up to eight sequential event times may be stored, in memory locations identified for reference as 1, 2, 3, etc., up to 8.
The memory locations are used as a storage 'stack' where location 1 always contains the most recent event time.
As each new event occurs its time-tag is stored in location 1 and all the previous event times are pushed down the stack by one place.
If the contents of the stack *are not* read out via a COM port, then, after eight events have been logged, further new events will still be stored as described above, but the oldest event time (in location 8) will be lost each time a new reading is added.

Event times made be examined on the EVENT page of the MAIN menu; this process does not erase the data. Alternatively, all the data may be read out via a COM port (RET Command); this action clears all the event storage locations to zero and so the locations are freed for further entries.

Location 1 always contains the most recent event time, and location 8 the oldest.
The storage of event times is in volatile memory, so a reset or a power-break will clear all the data.

GPS RECEIVER & Antenna

The GPS receiver used in the 2804A is an 8-channel, L1 carrier, C/A code SPS (Standard Positioning Service) receiver compatible with the satellite navigation signals as described in the GPS specifications SS-GPS-300B and ICD-GPS-200.

It is normally used with a fixed-pattern antenna which has RF damage protection for signals which are 100MHz or more from the L1 frequency (1575.42MHz) and have a received power level up to one watt. The receiver/antenna combination is resistant to jamming at J/S (jamming/signal) ratios of greater than +20dB measured at the antenna/preamp interface, when the L1 received signal level is -160dBW.

The receiver will provide a navigation solution that is specified at 25 metres (SEP) in the absence of Selective Availability. When SA is implemented, the position accuracy is degraded to 100 metres (2xdrms). The receiver provides a 1 per second timing pulse which is within ±1 microsecond of the GPS 'on-time' point whenever the received satellite signals allow a 2D or 3D navigation solution.

Acquisition

The receiver is completely self-initialising from a cold start but will exhibit differing 'Time to first Fix' according to the prevailing circumstances.
The fastest recovery from, say, temporary disconnection of the antenna or a short power failure, will normally be less than two minutes. After a longer period without power such as overnight switch-off, the acquisition process may take three minutes.
If the unit has been moved a very long way (>1000km) since last operating, then it may take over 5 minutes to re-acquire sufficient information to commence navigation. In extreme circumstances the 'Time-to-First-Fix' could be as long as 17 minutes, but this is extremely unlikely.

In normal circumstances in stationary applications, the receiver will be fully operational within four minutes of switch-on, provided that the Antenna is correctly connected and has a clear view of the sky without significant obstructions above the default mask angle of 10°.

Antenna Installation

The 2804A may be used with a Spectracom , Type 5b, GPS antenna. The Type 5b is currently supplied as a standard item.
The Type 5b is a fixed pattern antenna that has a built-in low-noise preamplifier, powered via the co-axial RF downlead cable from a low-voltage d.c. source (< 5 volts). This d.c. voltage is provided by the receiver in the 2804.
The antenna-head signal connector is a TNC; although sealed at its mounting face, this is not a truly weatherproof connector.
In order to provide weather protection for the interface between this connector and the downlead, a waterproof housing with an entry conduit is provided.
The entry conduit minimises water migration up the downlead, and also serves to reduce mechanical strain on the connector when the downlead is subject to sideloads; these may occur when the cable is being connected, or due to windage.
Spectracom antenna downleads, both the 20 metre version (E243) and the heavier 50 metre type (E244), are ready-fitted with a screw-on cable gland which allows the assembly to be weatherproofed at the point of cable exit. In extreme environments the user should provide further protection for the co-axial cable itself from its point of exit on the antenna assembly.
Information regarding antenna installation is given in Drg. No. 1008-8020 on the following page.
See also Appendices A and B for further information.

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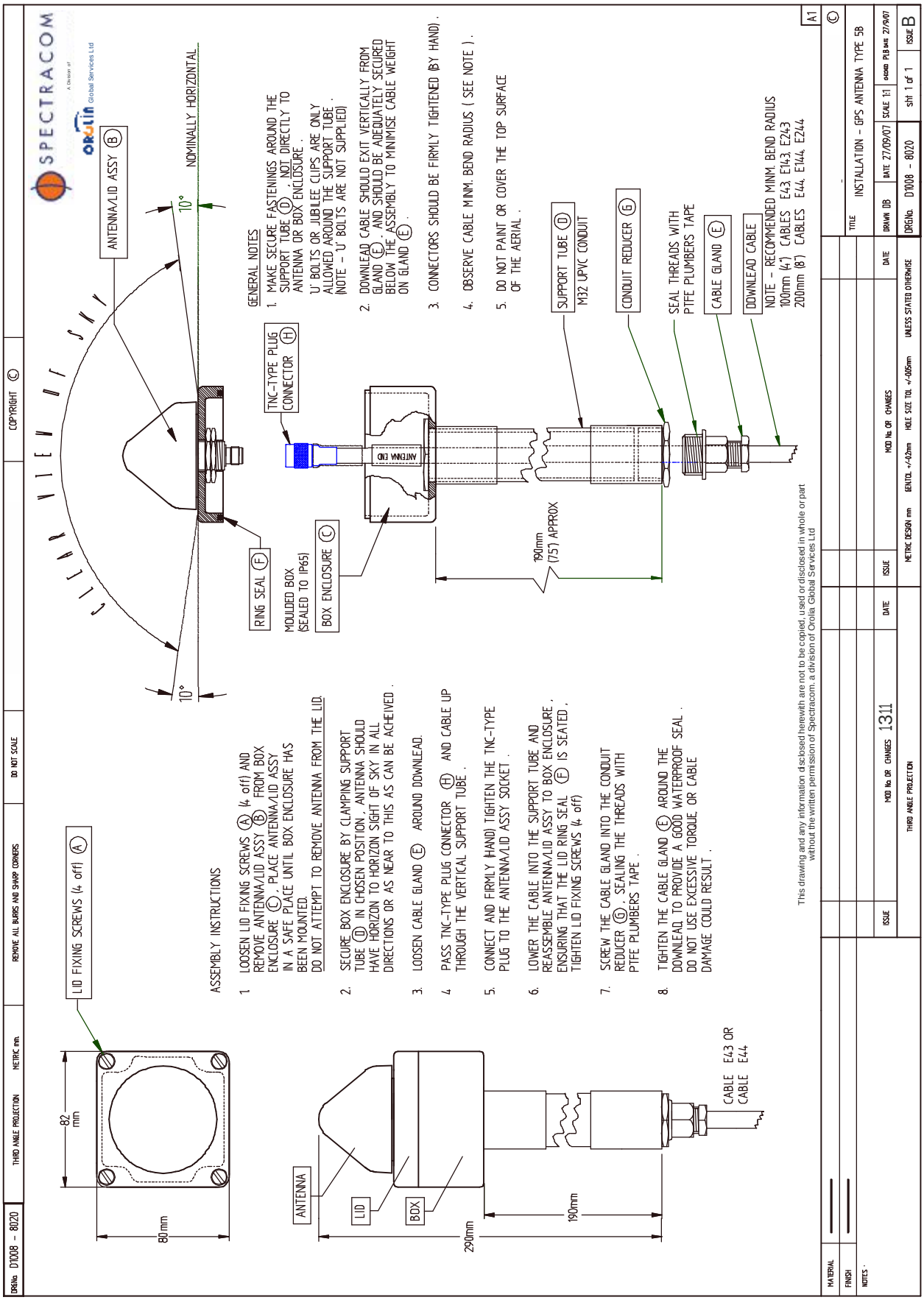
Drg. No. 1008-8020 - Type 5b Antenna Installation.



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ELECTROMAGNETIC COMPATIBILITY NOTES

The following special measures and limitations to use, should be observed when the equipment is taken into service, in order to maintain compliance with the EMC Directive 89/336/EEC.

Power Cables

a.c. Power

The a.c. power cables supplied with the unit(s) are the only approved type.

Always ensure that the green/yellow conductor is connected to a safety earth at the supply source.

Always ensure that the retainer clip is used to prevent accidental or partial disconnection of the power cable.

If the separate earth stud on the rear panel of the unit is connected to a local earth bus (eg in an equipment rack), ensure that this is a clean earth which is free from electrical noise.

d.c. Power

The d.c. power input and output ports on SPECTRACOM equipment are intended only for direct connection to other SPECTRACOM units, normally mounted in adjacent, or near adjacent, positions. The only approved cables for these purposes are those supplied by SPECTRACOM.

Signal, Data, or Antenna Cables

Where interconnecting cables are required between SPECTRACOM units, these are normally supplied with the equipment. Such cables should not be modified or extended; EMI absorbers (ferrites) or in-line filters supplied with cables should not be removed. Cables that interconnect with the users equipment and not supplied by SPECTRACOM, should be of correct specification and of adequate quality. EMC considerations involving such cables are the users responsibility. Consult SPECTRACOM if informal advice is required regarding choice of cables.

Unused input or output connectors

If any connector is unused in a particular installation, or if it is used only occasionally (eg. maintenance or test) then suitable protection should be used to ensure that the EMC profile of the unit is maintained as regards both immunity and emissions.

(i) Co-axial connectors should be fitted with screening (metallic) protective caps, or fitted with termination loads as required. Note that outputs designated TTL should not be terminated with 50 ohm loads.

(ii) Data connectors. To provide ESD protection and screening for unused multi-pin data connectors, it is recommended that an unwired mating part, complete with metallic hood and fixing screws or clips is fitted at the unused port. Suitable connector parts may be ordered from SPECTRACOM.

(iii) Antenna connectors. In normal applications these will be permanently connected to SPECTRACOM supplied antenna assemblies via SPECTRACOM cables. In the unlikely event that a unit is to be installed without the antenna downlead cable connected, protection in the form discussed above for data cables, is recommended. Note that where equipment is configured for use with an active antenna, the connector may have a d.c. voltage across its pins, and should not be fitted with a 50 ohm terminator as this could overload the power source; use a screened blanking cap or 'dummy' unwired connector instead.

Statement of Compliance for 2804A

SPECTRACOM A Division of OROLIA Global Services Ltd	**DECLARATION OF CONFORMITY** According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014	CE

Manufacturer's Name: SPECTRACOM
Manufacturer's Address: 6A Beechwood, Lime Tree Way, Chineham Business Park, Basingstoke. RG24 8WA

Declares under sole responsibility that the products as originally delivered:

Model Number	**Product Name**
2804	MASTER CLOCK

Product Options: This declaration covers all options of the above product(s)

comply with the essential requirements of the following applicable European Directives, and carry the CE marking accordingly:

Low Voltage Directive (LVD) 2006/95/EC
EMC Directive 2004/108/EC

and conform with the following product standards:

EMC **General Standard**
EN 61326-1:1997+A1:1998, A2:2001 & A3:2003

Reference Standards	**Limit / Severity**
Emissions	
CISPR 22:1997	Radiated Class A , Conducted Class B
EN 61000-3-2:2000	Mains Harmonics, Class A
EN 61000-3-3:1995	Mains Voltage Flicker
Immunity	
EN 61000-4-2:1995	4 kV CD, 4 kV AD
EN 61000-4-3:1996	3 V/m, 80-1000 MHz
EN 61000-4-4:1995	0,5 kV signal lines, 1 kV power lines
EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
EN 61000-4-6:1996	3 V, 0.15-80 MHz 1 cycle, 100%
EN 61000-4-11:1994	Dip, -100% for 20ms

SAFETY **General Standards**
BS EN 61010-1:2001
BS EN 60950-1:2006

SUPPLEMENTARY INFORMATION:

This DoC applies to above-listed products placed on the EU market after:

15 Aug 2007
Date

P.L.Baker
Technical Director

For further information, please contact your local Rapco Electronics Ltd sales office or agent.

File : CofC 2816

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APPENDIX A -- Antenna Installation guidelines

Spectracom 5 antenna assemblies are currently supplied for use with the 2804 unit. These items are described in a previous section of this Manual, GPS RECEIVER & ANTENNA.
Downlead cables are *not* normally supplied as standard with 2804 units because requirements vary from site to site. It is therefore preferable that each installation should be considered separately and the appropriate cable chosen, one of the most significant issues being that of rf loss.

SIGNAL LEVELS

The minimum received power level at the L1 frequency (1575.42MHz) from a high-elevation GPS satellite at an antenna near the earth's surface, is defined by the U.S. D.O.D. as -160dBW or -130dBm.
It is always signal-to-noise ratio that determines the performance of a receiving system, but at this low power level, items of equipment that might be taken for granted when dealing with conventional broadcast reception become very significant.
Even without the degradation brought about by imperfections in the receiver's front-end or amplifiers that may be used in its antenna, a GPS signal is 'buried' deep in the background noise that prevails in the reception of signals from space.
Conventional GPS receiving antennas are, to a first approximation, isotropic (i.e. not directional) so that they can receive equally well, and at the same time, from several satellites following various tracks across the sky. Such an antenna cannot be expected to significantly improve the signal-to-noise situation for the receiver, as would be the case with a directional (e.g. dish) type.

SIGNAL STRENGTH VARIATIONS

It is generally true that GPS receivers are designed to deal with considerable variations in signal strength. In the case of a Timing installation that uses a stationary antenna, it might be considered that signal strengths would be essentially constant, this is not in fact the case.
The received power from each satellite is dependent on its position relative to the antenna, and as the satellites are *not* in geo-stationary orbits, this power varies throughout the time that each satellite is visible. When near the antenna's 'visual' horizon, the signal from a particular satellite will be far lower than if it is nearly overhead; also the effects of multi-path propagation can cause significant variations in the effective signal level at the antenna.

RECEIVER PERFORMANCE

The receiver used in the 2804 requires that the average L1 signal power at its input should be of the order of -110dBm. To provide this power level, and to allow for some loss in the downlead, the antenna is equipped with a built-in Low Noise Amplifier (LNA) with a minimum gain of 32dB.
This allows reliable operation with a maximum cable-loss figure of 10dB at the L1 frequency.

ANTENNA SITING

The height of the antenna above the ground does not, to a first approximation, affect the received signal strength, but can be important in the sense that raising the antenna may reduce obscuration of its view due to nearby ground-based objects. Guidelines for choosing a mounting site are:

Give the antenna a good view in all directions as far as possible.

Keep away from known interference sources, particularly those at frequencies around 1.575GHz or sub-multiples of this frequency,
i.e. 1,575±40 MHz, 787±20 MHz, 394±10 MHz, etc.
UHF Terrestrial TV transmitters sometimes radiate significant power in the bands stated.

Try to avoid mounting the antenna adjacent to rf-reflective surfaces, e.g. brick or concrete walls, water tanks, lift-gear housings etc. Apart from the obvious obscuration of view that they may cause, such objects may also give rise to signal reflections that are undesirable.

Minimise the cable run length as far as possible, to reduce the signal loss.
See paragraph below, regarding cable quality.

DOWNLEAD CABLE QUALITY

Cables should be of adequate quality for reliable operation up to 1.6GHz. This requirement rules out the use of low-cost 'RG58' derivatives. Double-shielded cables are desirable unless the EMC environment is known to be totally benign, which is rarely the case; examples are:

RG400, which is a 5mm o/d cable that can be used for short runs up to about **20 metres**.

RG214, which is a popular 10mm o/d cable that can be used up to **30metres** total run.

The **E244 cable assembly** supplied by Spectracom is made with Westflex 103 or Belden 9913 semi-air-spaced, ultra-low-loss, double-shielded cable that allows a length of up to **50 metres** to be used without exceeding the 10dB loss target.

E244 cables are available at custom lengths, e.g. E244/30 for a 30metre version

Satisfactory installations have been achieved with this type of cable up to 70 metres run, but this is well beyond the maximum advisable length limit, and should only be applied if each cable is individually checked for rf loss at 1.6GHz.

In addition, great care must be taken to avoid damage during installation; air-spaced cables with a solid inner conductor are sensitive to tight bending. If bent more tightly than the minimum recommended radius (200mm), permanent internal damage may result, *damage that cannot be rectified by straightening out the bend.*

See Appendix B below for information on other cable types

MOUNTING TECHNIQUES

The 5b antenna should be attached to it's mounting pole, mast or bracket by means of straps around the black cable-entry conduit. This conduit is made from high -strength plastic material that will withstand considerable crushing loads due to the straps; nevertheless care should be exercised when tightening them. Plastic cable straps may be used for temporary rigs, but are not recommended for permanent installations because their strength is often diminished by prolonged weathering and exposure to UV. Stainless-steel pipe clips are a more suitable alternative.

When attaching the antenna to a mounting device, do not drill holes in any part of the antenna assembly. Secure the unit *only* by straps around the cable-entry conduit as stated above.

Do not allow any metallic mounting device such as a pole, to extend vertically beyond the base of the rectangular cable termination housing; this will avoid possible obscuration of the antenna by the mounting.

Suitable poles, wall brackets, etc. can often be sourced from suppliers of domestic TV antenna mountings. When a 'mast' is used, it may be as simple as a 2 or 3 metre pole to get the antenna above a roof edge or gutter line.

PROXIMITY TO OTHER ANTENNAS

Where *two* Spectracom 5b antennas are being installed, it is advised that they should be mounted at approximately the same height and at least one metre apart.

This allows the use of a one-metre cross boom with one antenna at each end; however, if storm damage is possible, (which is one reason for having two antennas) then a common mounting could be said to be defeating the object.

If the antenna is to be mounted in proximity to a third-party (non Spectracom) antenna, then a greater separation may be required.

If the third-party item is a receiving type (e.g. another GPS antenna) it may be a source of interference. Some early-model GPS receivers have poor suppression of the local oscillator radiation from their antennas; if this local oscillator frequency falls within the in-band limits for the receiver in the 2804 (see antenna siting paragraph above) jamming could result.

If the 'other' antenna is a transmitting type of any sort, particularly in the frequency bands previously noted, then it should be regarded as a possible source of interference.

In particular, on sites where radar equipment is operating, or where microwave-link antennas are installed, care should be taken to ensure that the GPS antenna is never in the beam-line of any such transmissions. This precaution is required not just to prevent interference, but also to avoid damage to the GPS antenna or its internal LNA. Even the radar on a small surface ship has very significant peak power output, and large ground-based radars are an even greater hazard in this respect.

APPENDIX B -- Installation solutions for GPS downlead cables.

Whilst not required as part of a normal antenna installation for an 2804, the following information is included for completeness.
The Spectracom E244 cable (standard length 50 metres) is adequate for the majority of installations; where the cable run exceed 50 metres, custom-length variants of the E244 can be supplied up to 70 metres (E244/70).
It is also possible to use downleads constructed with corrugated-copper shield cables, such as the Andrew Cable Type LDF4-50A, These can be used in installations where the cable run is as long as 120metres. but they come at higher cost than the conventional types, and require special tools and techniques to manufacture.
It should also be noted that none of the items of equipment referred to, i.e. amplifiers, special cables or Lightning protectors, are supplied as standard; they are all extra-cost items.

'ADD-ON' AMPLIFIERS

If site layout dictates a cable run longer than 50 metres, then an amplifier may be used to compensate for the signal power loss in a longer cable. GPS-oriented amplifier products are available from specialist manufacturers, and can be supplied by Spectracom.
Typically a single amplifier unit is a fully enclosed (but not normally weatherproof) assembly with N-type input and output connectors for the rf signals.
Power (d.c.) is required to bias the amplifier circuit and this is typically supplied at +5V.
This d.c. supply may be fed via the core of the co-axial rf cable itself (in the same way as the GPS receiver normally powers the antenna LNA), or through a separate connector from an external source.
Alternatively, amplifiers are available complete with low-voltage 'plug-top' power units that are compatible with normal 230V 50Hz UK supplies; units for operation from 115V 60Hz supplies are also available under different part numbers.

AMPLIFIER POWER REQUIREMENTS

The GPS receiver used in the 2804 is equipped for supplying d.c. to a single antenna at +5V with a typical current demand of 25mA. It is not capable of supplying the additional d.c. load due to an additional amplifier of the type that is fed via the cable core.
Therefore, add-on amplifiers for use with the 2804 should be of the type that are externally powered, and which have provision to pass additional current to the antenna.
The external power unit then provides d.c. to both the antenna LNA and the add-on amplifier.
Because small ac/dc power modules may have poor regulation, a regulator is frequently incorporated in the add-on amplifier so that its internal circuits and those in the antenna head, receive a stable voltage, (+5V in the case of the Spectracom equipment)
To avoid conflict between the dc supply on the 2804 antenna port and the d.c. supply in the amplifier, the amplifier rf output port is d.c. blocked (i.e. capacitively coupled).

GAIN & NOISE FIGURE

Add-on amplifiers usually have a fixed gain (20dB minm.) at the L1 frequency, although variants are obtainable with 40dB of gain at considerably higher cost.
Their Noise Figure is modest, (3.5dB maxm. at +25^{O}C) so the benefits that result from fitting them are usually a little lower than may at first be expected.
For instance, if a 50 metre low-loss cable exhibits an rf loss of 10dB as discussed above, then it might be thought that add-on amplifier with 20dB gain would allow another two such cables (100 metres = 20dB) to be used, giving a total of 150 metres. This would be optimistic, since it ignores the noise contribution of the add-on amplifier and the additional small losses associated with its installation (connectors etc.); 130 metres total might be a more conservative estimate.
In practice, optimism is often justified, because add-on amplifiers have *typical* gain of +25dB and *typical* Noise Figure of 3dB. However, amplifier and antenna manufacturers consistently fail to specify the Gain and Noise Figure for the complete temperature range over which their products are intended to work….caution is advised !
The operating range is -40 ^{O}C to +85^{O}C for the antenna and -40 ^{O}C to +75^{O}C for the add-on amplifiers.

Since it is signal-to-noise ratio that counts, it may be deemed a nett advantage to put the amplifier near antenna end of the cable system, but this may be inconvenient for two reasons.

1. The amplifier assembly, unlike the antenna itself, is not weatherproof.
2. Even if the amplifier is mounted within a weather-protected area such as a loftspace, a power source may not be available in that particular location.

In practical terms it is usually sufficient to try to fit the amplifier within a distance of d/3 from the antenna where d is the total cable length.

LIGHTNING PROTECTION

For installations where protection against Lightning (LEMP event) is considered desirable, then suitable in-line protection units for the antenna Downlead are available (at extra cost) from Spectracom.

Such devices will not protect the antenna against a direct strike, even one of low magnitude. Should this occur, the antenna will almost certainly be destroyed and will require replacement.

The 'side-effects' of nearby strikes, such as high static fields, may be contained by Lightning protectors in certain circumstances.

The installation of an in-line protection device is a relatively low-cost means of reducing the severity of damage propagation to downstream equipment, and may be considered worthwhile particularly in locations where severe lightning storms are endemic.

Since the effectiveness of such devices cannot easily be quantified, their use is recommended only as a prudent precaution.