Rapco

Equipment Handbook

RAPCO Type 1804M MK2
GPS Precision Frequency Source

RAPCO Type 1882M1 MK2
AUTO CHANGEOVER UNIT

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Designed and manufactured in the U.K.

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EQUIPMENT HANDBOOK

For

RAPCO Type 1804M MK2

GPS Precision Frequency Source

Configuration list for this variant

GPS L1 C/A Signal Compatibility

5MHz Drift Corrected reference

1Hz Drift corrected 'on-time' Output

Serial RS232 I/F (Terminal & Remote modes)

Dual Alarm Outputs

Issue 3 Nov 1998

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Contents -- (contd.)

The following additional information is appended at the end of this handbook

ITEMS LISTS

DRAWINGS

SPECIFICATION

GPS Precision Frequency Source Type 1804M MK2

A.C. POWER SUPPLY	:	230V rms, Single Phase.
Power loading	:	40VA maxm., 25VA typical
Voltage range	:	196V to 264V
Frequency range	:	45Hz to 66Hz.
a.c. fuse rating	:	315mA anti surge (T315mA 250V), 20 x 5mm
POWER CONNECTOR (a.c. input)	:	J1 3 pin IEC mains connector to CEE22 and BS4491
	:	Mating socket with 2 metre cable supplied.
	:	Colour coding to UK standards,
		brown = Live
		blue = Neutral
		green/yellow = Earth
CONNECTOR (d.c. output/alarm)	:	J2 7-way profDIN socket
	:	(See Drg. No. 3302-5345)
		Connect only to Rapco 1882 distribution unit
		Pins 7,3 +ve. Pins 6,1 –ve. Pin 2 alarm O/P.
SIGNAL CONNECTORS		
RS232 Port	:	J4 9-way 'D' socket
Frequency Outputs		J5 5MHz sinewave outputs to 1882
		J6 1ppS TTL squarewane distribution unit
GPS Aerial (Antenna)	:	J3 L1 signal input, 50ohm, N type socket.
		Note: Socket carries 5v supply to antenna preamp.
		Connect only to an approved GPS antenna.
Alarm Contact	:	J7 BNC (50ohm) voltage-free / shell grounded (Alarm 1)
INDICATORS (front panel)		
GPS Status	:	(green)
Control Status	:	(green)
A.C. Power	:	(red neon, intergrated with power switch)
Alarm 1	:	(red)
Alarm 2	:	(red)

Specifications -- (contd.)

PRIMARY FREQUENCY REFERENCE : Internal Oscillator, 5MHz SC quartz

Stand Alone stability - typical, uncorrected.

Drift rate (ageing) : $< \pm 5$ in 10^{10} per day, after 30 days operation (decreasing with age)

Drift corrected Accuracy (ref: USNO) - GPS on, Installed rack environment

V. long term : ± 5 in 10^{11} typical
24hr. average : $< \pm 1$ in 10^{10}

All frequency performance figures apply following a 7-day stabilisation period from initial switch-on, and assume continuous powering thereafter. Installed rack environment implies a quasi-constant temperature in the range $26^{o}C \pm 10C^{o}$.

TEMPERATURE RANGE

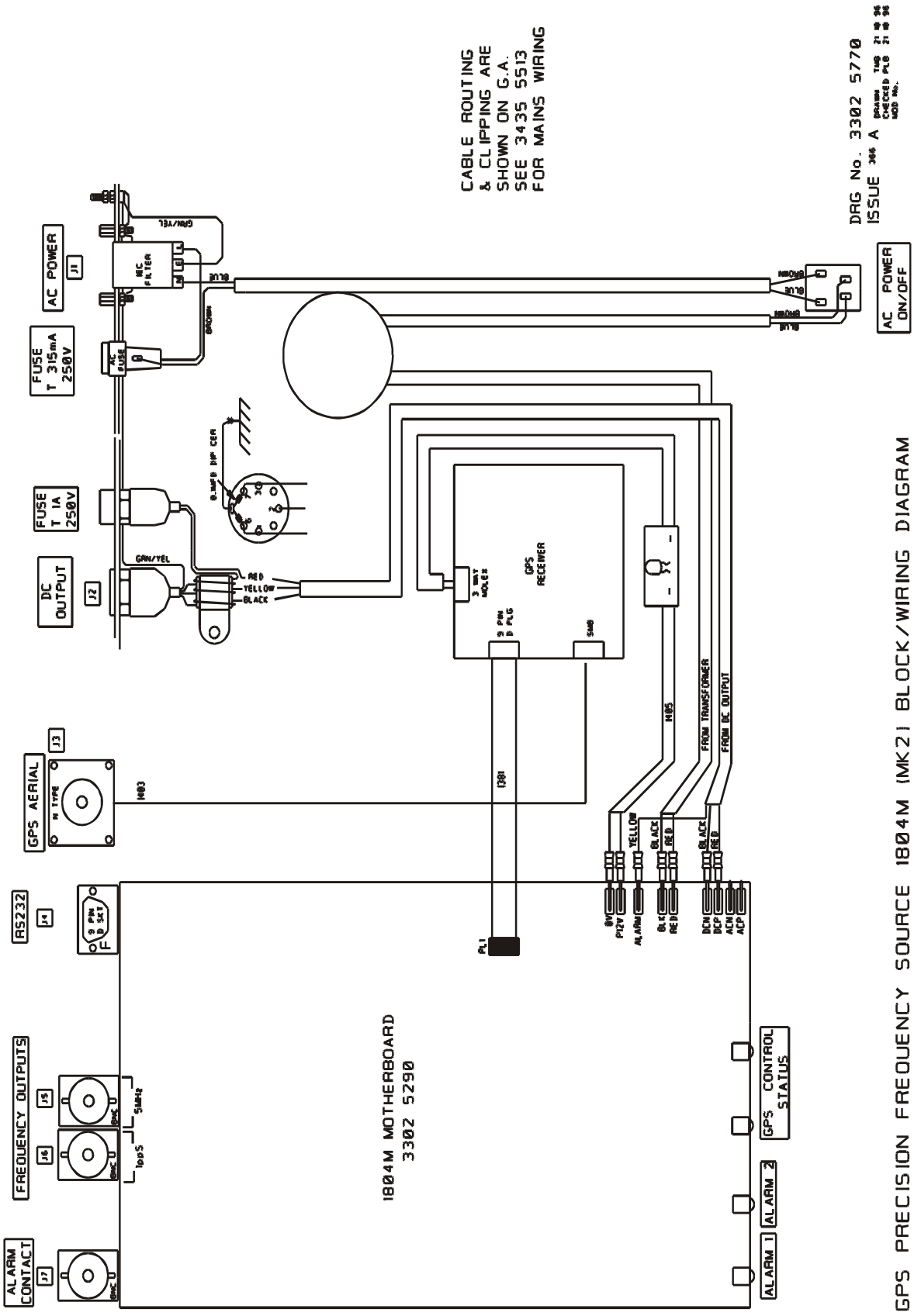
(i)	Rack Mount Unit	Operating	:	$0^{o}C$ to + $50^{o}C$ RH 90% (non-condensing)
		Storage	:	$-40^{o}C$ to $+70^{o}C$ RH 30%
(ii)	Antenna Unit	Operating	:	$-40^{o}C$ to + $70^{o}C$ RH 100% (condensing)
		Storage	:	$-55^{o}C$ to + $85^{o}C$ RH 30%

SIZE Width : 483mm
Height : 44mm
Depth : 350mm excluding rear panel connectors.

FIXING POINTS : Standard rack fixing holes in front panel.

FINISH : Black Semi Gloss paint on front panel outside surfaces with white legends and lettering.
: Alocrom 1000 conductive finish on all other surfaces.

Drg. No. 3302 5770 Block/Wiring Diagram Type 1804M MK2



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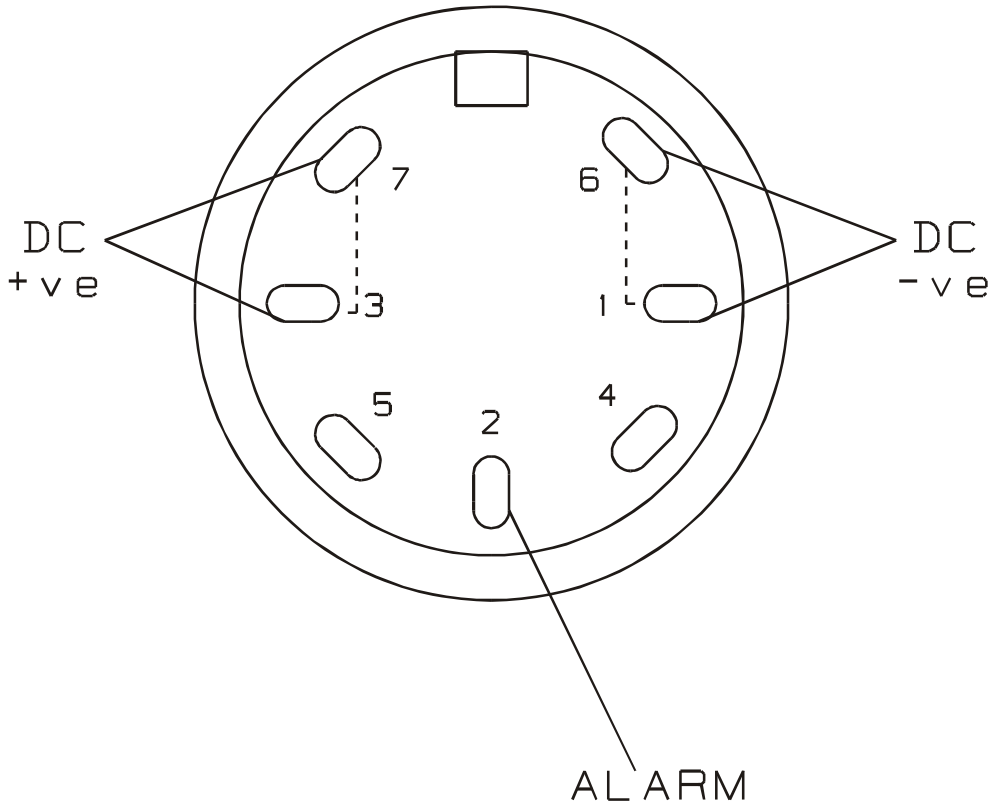
Drg. No. 3302 5345 dc-power output connector

W/O NO.	DRG.NO.
3302	5345
USED ON	1804M / 1882M DC/ALARM CONN.

7 WAY DIN PROFESSIONAL SOCKET. FACE VIEW.



RAPCO CAD

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ISSUE	DATE	MOD NO.
356 A	07 08 95	X

W/O NO.	3302		
FIRST ISSUE	DATE	RAPCO ELECTRONICS LTD.	
DRAWN PLB	07 08 95	TITLE 1804M / 1882M DC/ALARM CONN.	
CHECKED TMB	07 08 95	ORIG. SIZE A4	DWG NO. 5345
		SCALE X	SHEET 1 OF 1

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OPERATING INSTRUCTIONS

The 1804M(MK2) is intended for continuous powering from 230V nominal 50Hz supplies.

The a.c. on/off switch is located on the front panel. Power cables for a.c. are supplied with the unit.

The GPS Aerial must be installed in a suitable outside location (clear view of sky), see RAPCO Drg. No. 2929-6186. The aerial cable should then be connected to J3 at the rear of the unit.

When the a.c. supply is first established, the 1804 will initially show (red neon) A.C POWER on; the GPS and CONTROL STATUS lights will be off. After a few minutes the GPS STATUS light will come on, indicating that the GPS receiver has locked on the satellites (see below). Subsequently the CONTROL STATUS light will switch on. This indicates that the frequency reference oscillator oven is approaching its correct working temperature, and that the frequency control system has started drift correction. The CONTROL STATUS indicator may switch off again during normal operation if the frequency reference should be disturbed by (say) a power break, GPS failure etc. Under these circumstances the oscillator control voltage is locked at the previous value (held in non-volatile memory) until the drift-correction process has re-started.

Status at Power-up

After power-on, the GPS receiver will normally start to provide a position fix within 2 minutes, but if the unit has been moved a very long way from its previous position, or if a very long time has elapsed since it was switched on, then this 'Time to First Fix' could be as long as fifteen minutes. In any case the GPS Aerial must be correctly installed and connected to the unit with a suitable cable.

When the GPS receiver has locked on to sufficient satellites the green GPS status indicators will come on, and the time output data (1 pps and serial RS232 data) will be corrected to satellite time.
The unit will power up to either UTC or GPS time according to previous use, since the timing mode is stored in non-volatile memory.

The output signals at the rear panel will be active from power-up, but the accuracy of the frequency output will be dependent on the status of the frequency control system as displayed by the system status indicators. (See subsequent section).

The serial RS232 port will be active from power-up and will, by default, set to the TERMINAL (continual transmission) mode.

POWER-ON CONDITION

The power-on condition is as follows:

Timing mode (UTC/GPS) ..... Dependent on state at previous power fail.

RS232 Port ..... Active in TERMINAL mode

Time/date output ..... time/date from battery support clock (circa 1 sec/day error)

Frequency System Status ..... CONTROL STATUS 'off' (locked at previously used value)

THE SERIAL (RS232) INTERFACE

The Serial interface is connected via a 9-way 'D' type socket (DE9S), J4 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

Chassis (Protective Ground)

SDI - Serial Data - INPUT

SDO - Serial Data - OUTPUT

DTR - Data Terminal Ready - OUTPUT

Signal Ground

RTS - Ready to Send - OUTPUT

CTS - Clear to Send - INPUT

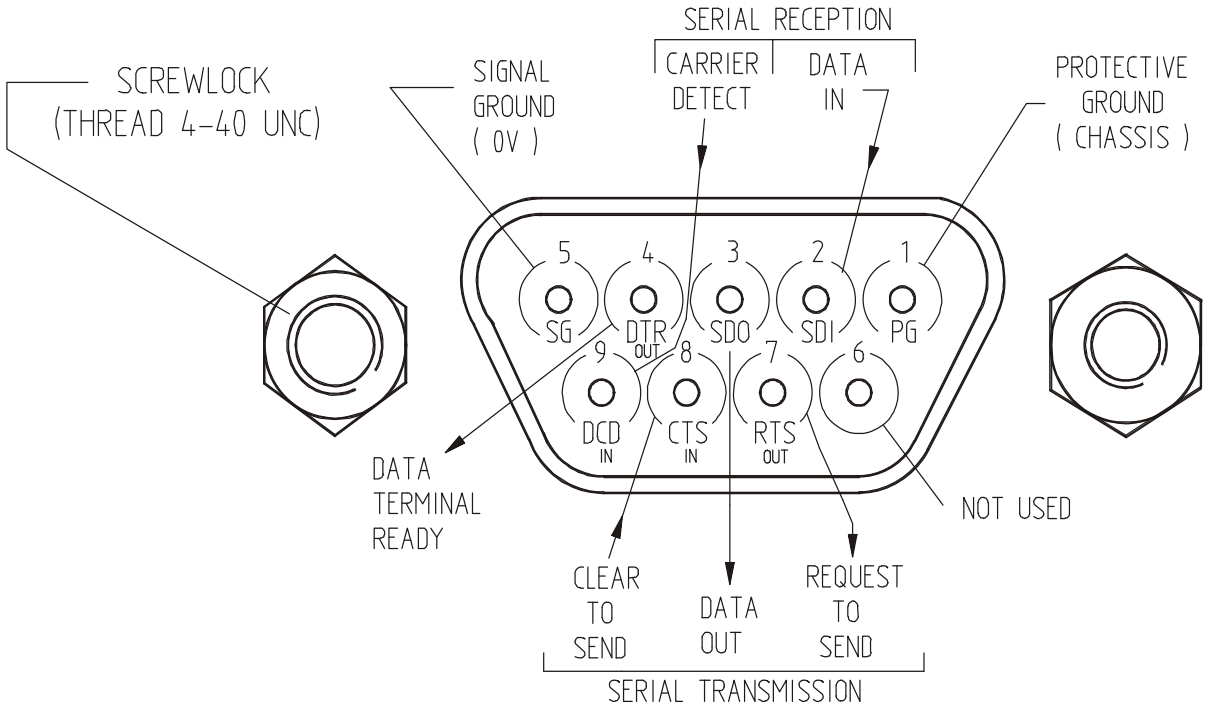
Serial Communication parameters are not user adjustable; they are set by the unit's internal software as follows:

Character format 8 bits

Baud Rate 4800

Stop Bit Length 1 bit

Parity None



FACE VIEW OF FIXED SOCKET (DE9S)
≡ WIRING FACE OF MATING PLUG

NOTE (i) CTS AND DCD INPUTS MAY BE LEFT UNCONNECTED IF NOT USED.
(ii) DATA PROTOCOLS MAY DEPEND ON INDIVIDUAL UNIT SPECIFICATION, SEE UNIT HANDBOOK .

DRAWN : DB DATE : 23/6/92
CHKD : PLB DATE : 24/6/92

RS.232 SERIAL INTERFACE
9 WAY SOCKET CONNECTOR

DRG No. 2840-4228
ISSUE C
MOD No.1027 27/5/97

OPERATING MODES

The RS232 port can operate in two distinct modes:

(i) **TERMINAL -** where the port will output a continual fixed format sequence of data from the 1804 which can be displayed on a 'dumb' terminal, this is useful for evaluation and confidence-checking of the units operation.

In this mode only 3 commands are accepted, which are

<Control>S stop display scroll

<Control>Q start display scroll

? change serial mode (to REMOTE)

Any other command will be ignored, no delimiters are necessary. The unit will power-up (or reset) to this mode.

(ii) **REMOTE -** In this mode the port accepts a number of remote control commands allowing full remote control and interrogation of the unit.

In this mode the ? command remains available to allow a return to the TERMINAL mode if required. Errors will invoke a defined error message. See below for command structure details; note that <CR> delimiters are required on all commands and that <CR><LF> will be sent with responses.

The data transmitted in the TERMINAL mode allows the display of time and position messages on any 'dumb' terminal device. (ASCII characters at 4800 Baud). See below for example of format.

Operating modes -- (contd.)

Fixed Format Output (TERMINAL mode)

ASCII character strings (at 4800Bd, 8 data, No Parity, 1 Stop) are transmitted as follows:

At every second, a time-date message.
Every ten seconds, a position and satellite data message

Example: UTC Time :10:33:41 26/06/92

UTC Time :10:33:42 26/06/92

etc

UTC Time : 10:33:49 26/06/92

UTC Time : 10:33:50 26/06/92

Position : 51 16.425N 001 06.040W 107m

PDOP : 6

SAT PRN : 03,12,20,24,25

SAT Level : 09,11,24,12,15

Fix, Mode : 3D, Fine

UTC Time : 10:33:51 26/06/92

UTC Time : etc.

'Fix' indicates the current state of the GPS receiver where 1D fix shows single satellite (timing only) operation and 2D or 3D show 3 satellite or 4 satellite (time & position) working.
'Mode' indicates the current state of the units frequency reference drift correction system which may be 'Inactive' or in 'Coarse' or 'Fine' modes.

In addition to the above data, when the unit is operating in the 'Fine' or 'Coarse' modes the frequency control voltage value may occasionally be inserted (when it has changed) as an ASCII-hex number.

Thus: DAC Output : 1D57

Also, on power-up or reset, the GPS software number is transmitted,

e.g. GPS S.W :01.00 08/20/92 01.00 08/20/92.

Note:- (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)

When the unit has been operating for sufficient time and with adequate reception conditions, an average position calculation is made which removes some of the second-by-second variations in the position solution. This calculation requires that a total of 256 position fixes have been received, each with a PDOP of 2 (or better) in order that a good average can be obtained.

The prefix 'Avg.Posn' will be used to identify this data line, and when available it will be inserted with the satellite data package at one minute intervals (on the minute).

The Average Position calculation is valid only in stationary or quasi-stationary applications where the long period required to gather the data does not present a problem. Under good GPS reception conditions, it will take at least 5 mins. (in addition to the time-to-first-fix) to recalculate the Average Position from a power-up or major change in position.

THE CONTROL COMMAND SET (REMOTE mode)

Command Format

The command format used on the serial RS232 control port is of the form

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

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

Command List

The following standard commands are recognised in the REMOTE mode.

Format	Command Name
RA<CR>	Read 1804 status
RB<CR>	Read GPS rcvr status
RC<CR>	Read GPS rcvr version
RK<CR>	Read Satellite PRN
RL<CR>	Read Satellite signal level
RO<CR>	Read Local time offset
RP<CR>	Read Position
RQ<CR>	Read Avg. Position
RT<CR>	Read Local date & timeRNT<CR> Read Next Local date & time
RU<CR>	Read UTC/GPS date & time
RNU<CR>	Read Next UTC/GPS date & time
SDx<CR>	Set 1 satellite (timing only) mode
RV<CR>	Read Reference control voltage
SOshhmm<CR>	Set Local time offset
TU<CR>	Set timing mode to UTC
TG<CR>	Set timing mode to GPS
VL<CR>	Lock Reference control voltage
VU<CR>	Unlock Reference control voltage
Dxnnnn<CR>	Set Alarm time delayDx<CR> Read Alarm time delay
Wabcxyz<CR>	Wrap (test)
Z<CR>	Instrument reset (software)
? (no delimiter req'd)	Change serial mode (to TERMINAL)

COMMAND and RESPONSE DETAIL

RA<CR> Read 1804 status

Response RAxy<CR><LF>
where x is ASCII coded hex representing
bit 3 n/u
bit 2 n/u
bit 1 GPS status 1 = OK
bit 0 Drift Correction status 1 = not correcting

y is ASCII coded hex representing
bit 3 Drift Correction fine mode, 1 = fine) 00 = not
bit 2 Drift correction coarse mode, 1 = coarse) correcting
bit 1 Drift correction remote lock, 0 = unlocked 1 = locked
bit 0 UTC/GPS select 0 = UTC 1 = GPS

RB<CR> Read GPS rcvr. status

Response RBabcdefghjk<CR><LF>

where a = n/u - state undefined

b = 0 - Doing position fixes
= 1 - No GPS time available
= 3 - PDOP is too high
= 8 - No usable satellites
= 9 - Only 1 usable satellite
= A - Only 2 usable satellites
= B - Only 3 usable satellites
= C - The chosen satellite is unusable

c is ASCII coded hex representing
bit 3 n/u
bit 2 n/u
bit 1 Excessive ref freq. error
bit 0 n/u

d is ASCII coded hex representing
bit 3 Alignment error channel/chip 2
bit 2 Alignment error channel/chip 1
bit 1 Signal processor error
bit 0 n/u

ef is the GPS rcvr. id. code. e.g. '14' dependent on issue.

g = n/u

h is ASCII coded hex representing
bit 3 n/u
bit 2 n/u
bit 1 n/u
bit 0 Synthesizer fault
j, k = n/u

COMMAND & RESPONSE DETAIL (cont'd)

RC<CR> Read GPS rcvr. s/w version

Response RCaabbccddeeffgghhjjkk<CR><LF>

where aa,bb...kk are ASCII coded decimal numbers representing

aa = Nav proc - Major version No.
bb = Nav proc - Minor version No.
cc = Nav proc - Month
dd = Nav proc - Day
ee = Nav proc - Year No.
ff = Sig proc - Major version No.
gg = Sig proc - Minor version No.
hh = Sig proc - Month
jj = Sig proc - Day
kk = Sig proc - Year No.

RK<CR> Read satellite PRN

Response RKaa,bb,....ff,gg<CR><LF>

Where aa, bb etc. are ASCII coded decimal representing the PRN for each satellite which the GPS rcvr. is tracking or attempting to track.

RL<CR> Read satellite level

Response RLaa,bb,....ff,gg<CR><LF>

where aa, bb etc. are ASCII coded decimal representing the signal level for each satellite corresponding to the PRN in the RK response.

RO<CR> Read Local time offset

Response ROshhmm<CR><LF>

Where s is the sign of the offset '+' or '-'
hh is ASCII coded decimal hours offset '00' to '59'
mm is ASCII coded decimal minutes offset '00' to '59'

RP<CR> Read Position

Response RPddmm.mmmadddmm.mmmbhhhh Pxx<CR><LF>

where ddmm.mmm are the degrees & minutes of position in ASCII coded decimal a is 'N' for North or 'S' for South (Latitude)
b is 'E' for East or 'W' for West (Longitude)
hhhh is the Height in metres in ASCII coded decimal Pxx is the current PDOP statistic.

COMMAND & RESPONSE DETAIL (cont'd)

RQ<CR> Read Average Position

Response RPddmm.mmmadddmm.mmmbhhhh<CR><LF>

where ddmm.mmm are the degrees & minutes of position in ASCII coded decimal
a is 'N' for North or 'S' for South (Latitude)
b is 'E' for East or 'W' for West (Longitude)
hhhh is the Height in metres in ASCII coded decimal * See definition of Avg. Posn. calculation under Terminal Mode section.

RT<CR> Read Local date & time (UTC or GPS, plus offset)

Response RTyymmddhhmmss<CR><LF>

Where yy is ASCII coded decimal year '00'-'99'
mm is ASCII coded decimal month '01'-'12'
dd is ASCII coded decimal day '01'-'31'
hh is ASCII coded decimal hours '00'-'23'
mm is ASCII coded decimal minutes '00'-'59'
ss is ASCII coded decimal seconds '00'-'59'

RNT<CR> Read Next Local date & time

This command causes the 1804 to wait until the next 'on-time', second roll over point, and then transmits the new time. Delay from end of command delimiter to start of response will vary, and may be slightly longer than one second (1.1 second maxm.)

The delay from the true 'on-time' point to the start bit of the first character in the response will be nominally 0.5 millisecond. Software timing tolerances may cause the delay to vary in the range 0.2msec. to 0.8msec.

Response RNTyymmddhhmmss<CR><LF>

Where yy etc. are as in RT command above

Note Sending any other command to the unit before the new time response has been sent will cancel the RNT command and no new time will be sent.

RU<CR> Read UTC/GPS date and time

Response RUyymmddhhmmss<CR><LF>

Where yy is ASCII coded decimal year '00'-'99'
mm is ASCII coded decimal month '01'-'12'
dd is ASCII coded decimal day '01'-'31'
hh is ASCII coded decimal hours '00'-'23'
mm is ASCII coded decimal minutes '00'-'59'
ss is ASCII coded decimal seconds '00'-'59'

COMMAND & RESPONSE DETAIL (cont'd)

RNU<CR> Read Next UTC/GPS date & time

This command causes the 1804 to wait until the next 'on-time', second roll over point, and then transmits the new time. Delay from end of command delimiter to start of response will vary, and may be slightly longer than one second (1.1 seconds maxm.)

The delay from the true 'on-time' point to the start bit of the first character in the response will be nominally 0.5 millisecond. Software timing tolerances may cause the delay to vary in the range 0.2msec. to 0.8msec.

Response RNUyymmddhhmmss<CR><LF>

Where yy etc. are as in RU command above

Note: Sending any other command to the unit before the new time response has been sent will cancel the RNU command and no new time will be sent.

SDx<CR> Set/Unset 1 - Satellite (timing only) mode

Where x = 1 = one satellite mode
x = 3 = 3/4 satellite nav. mode

Response SDx<CR><LF>

RV<CR> Read Reference control voltage

Response RVaaaa<CR><LF>

Where aaaa is ASCII coded hex of the control voltage '0000'-'FFFF'

SOshhmm<CR> Set Local time offset

Response SOshhmm<CR>

Where s is the sign of the offset '+' or '-'
hh is ASCII coded decimal hours offset '00' to '23'
mm is ASCII coded decimal minutes offset '00' to '59'

TU<CR> Set timing mode (display and output) to UTC

Response TU<CR><LF>

TG<CR> Set timing mode (display and output) to GPS

Response TG<CR><LF>

VL<CR> Lock Reference control voltage

Note: Locking the oscillator control will cause the CONTROL status indicator to switch off; it will remain in this state until the control voltage is unlocked and the frequency correction system has resumed control.

Response VL<CR><LF>

COMMAND & RESPONSE DETAIL (cont'd)

VU<CR> Unlock Reference control voltage
Response VU<CR><LF>

Dxnnnn<CR> Set Alarm Time delay

Response Dxnnnn<CR><LF>

Where x = A, B. C or D (Delay identifier)
nnnn = 4 digit ASCII Hex number representing the
a larm delay in seconds.

Example: nnnn = 012C = 300 secs. = 5 mins.
See section below on Alarm Output System.

Dx<CR> Read Alarm Time delay

Response Dxnnnn<CR><LF>

Where x, n are as above.

Wabcxyz<CR> Interface test (Wrap)

Response Wabcyz<CR><LF>

Where abcxyz are ASCII alphanumeric characters

Z<CR> Instrument reset (forces software reset)

Response NONE - N.B. No commands should be sent to the unit for 1 second following this command.

ERRORS

Any command error will respond with ERx<CR><LF> in place of the usual command response, when the unit is in the REMOTE mode.

Where x = 1 Command format error

x = 2 Command parameter error.

INTERPRETATION OF STATUS BITS

The status bits returned in the RA command response may be interpreted as follows.

Bit x1, weight 2 - GPS Status

This bit reflects the state of the front panel GPS STATUS indicator and is high when the light is 'on' indicating good status, i.e. sufficient satellites and signal levels for normal operation.

Bit x0, weight 1 - Drift correction status

This bit reflects the state of the front panel CONTROL STATUS indicator and is high when the light is 'off' indicating that the frequency drift correction system for the internal oscillator is not operating. This may be due to any one of three conditions, which are:

Drift correction locked off by remote command (VL)
Insufficient time since switch-on, or power break (oven temperature)
GPS status failure (insufficient reference integrity)

The y3, 2, 1 bits contain additional information regarding the current state of the drift correction system.

Bits y3/2 weight 8/4 Drift correction fine/coarse mode

These bits define the current state of the drift correction system which may be in a 'fine' control mode (bit 3=1) when the system is in a stable environmental state with good GPS data, or in a 'coarse' control mode (bit 2 = 1) when the system has recently suffered a change in conditions such as a large temperature gradient, a GPS failure or a power break. If both bits are zero, the drift correction system is not operating and the oscillator control voltage will be locked at the last known 'good' value.

Bits y1, weight 2 - Drift correction remote lock

This bit is set high when the drift correction system is locked by remote command i.e. previous use of the VL command; it will remain in this state until locked via the VU command, or when the unit is reset following a power break. This bit only reflects whether a remote lock command is currently in force, it does not imply any other status conditions.

FREQUENCY OUTPUTS

The 1804M(MK2) is fitted with sockets on its rear panel whichprovide drift corrected frequency outputs from the units internal refere4nce oscillator.
these are configured as follows:
J5 5MHz (sine)

This output provides a drift-corrected frequency reference which is buffered from the internal oscillator. The output waveform is derived from a CMOS gate array driving a 2 pole LC filter giving a near sinusoidal waveform of nominally 2.5V p-p into the 1882M distribution unit.
J9 1 pps (TTL)

This output is driven by a 5V HCMOS buffer capable of driving two standard TTL loads and is normally interconnected to the 1 pps (Master or Standby) inputs of an 1882M distribution unit. The output waveform is a squarewave at a frequency of 1Hz. In normal operation the positive going transition of the signal is phase controlled to align with the GPS on-time point and is used to trigger an output pulse (20usec) generator in the 1882M.

GPS RECEIVER AND AERIAL

The GPS receiver used in the 1804M(MK2) is a 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 used with a fixed-pattern microstrip (patch) aerial 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/aerial combination is resistant to jamming at J/S (jamming/signal) ratios of +24dB measured at the aerial/preamp interface, when the L1 received signal level is -160dBW.

The receiver will provide a navigation solution which 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 aerial 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, or if its internal clock is in error by a large amount (>10 minutes) 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 on slow moving platforms or in stationary applications, the receiver will be fully operational within four minutes of switch-on, provided that the aerial is correctly connected and has a clear view of the sky without significant obstructions above the default mask angle of 10o.

Aerial Installation

The GPS aerial supplied with the 1804 is a microstrip (patch) type which has a built-in preamplifier, powered via the co-axial RF signal cable from a low voltage d.c. source (< 5 volts).

Its signal connector is an SMA type, which, although sealed at its mounting face, is not a weatherproof connector.

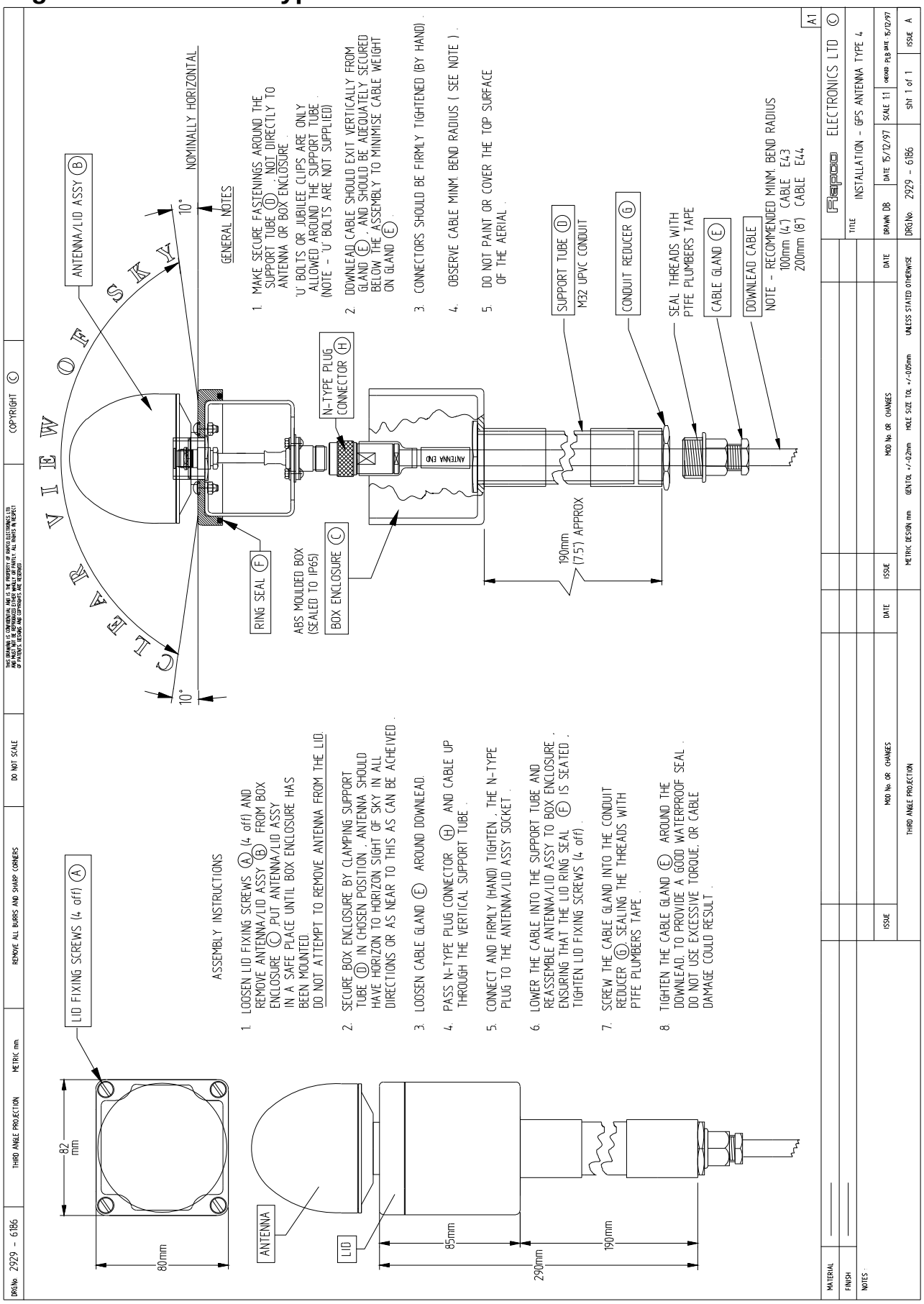
GPS Receiver and Aerial (cont'd)

To provide protection for the interface between this aerial and the aerial cable, a waterproof housing with an entry conduit is provided. RAPCO aerial cables, both the standard 20 metre version and the heavier 50 metre (C50 option) type, 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 aerial assembly.

Information regarding aerial installation is given in Drg. No. 2929-6186, which depicts the standard aerial assembly (Type 2). An alternative aerial assembly is available for use with the 1804M, this is identified as the Type 3 and is shown in Drg. No. 2929-5311. Standard aerial cables are interchangeable between the two antenna assemblies.

Drg. No. 2929-6186 - Type 4 Antenna Installation.



THE ALARM OUTPUT SYSTEM

An alarm contact output is presented at a BNC connector at J7; this is identified as Alarm 1, and is intended for user connection to the stations' alarm management system.
The voltage-free alarm relay contacts are wired between the inner and outer contacts of this connector and 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 connector is connected to chassis (ground).

The contact ratings are 30V, open circuit, maxm. and 0.5A d.c. current, closed circuit, maxm.

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; this is a TTL compatible logic signal which is connected via the d.c. power output connector J2, to provide an alarm state indication to the 1882M distribution unit. This signal is configured as (TTL low = no fault)
(TTL high = fault)
Alarm 1 and Alarm 2 are fitted with red status indicators on the 1804M front panel which show the current state of each alarm where:
(indicator off = no alarm
(indicator on = alarm state

Programmable time delays may be applied to the onset of alarm indications, see below for details.
Values of nnnn describe the time delay in seconds with hexadecimal digit ranges.

For example: 0001 = 1 second (minimum delay)
000A = 10 seconds
012C = 300 seconds = 5 minutes
0258 = 600 seconds = 10 minutes
0E10 = 3600 seconds = 1 hour
FFFF = 65535 seconds = 18 hours, 12 minutes, 15 seconds

The setting nnnn = 0000 is reserved as a special case. For maintenance and system testing the setting of this delay value as DA or DB will immediately set the ALARM 1 output, regardless of whether a fault condition exists; similarly DC or DD, if set to 0000, will set the ALARM 2 output unconditionally.

Because the 'zero delay' setting is reserved for this test function, the minimum usable delay setting is 1 second e.g. DA0001<CR>. The factory (reset/default) setting for the delay values is 5 minutes (012C) for each delay.
An alarm state will be initiated by the software under any of the conditions listed below:

(i) GPS Receiver not providing a 2D or 3D fix. (ii) Oscillator control voltage outside normal range.
(even if oscillator is on frequency) (iii) Oscillator off frequency (even if control voltage is normal).
will extinguish the GPS status indicator,(i), (ii) or (iii) will extinguish the CONTROL status indicator.
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 (Station Alarm) and ALARM 2 (Changeover-Unit Alarm), so four setting commands are available.

These are: DAnnnn - sets ALARM 1 (GPS) delay

DBnnnn - sets ALARM 1 (CONTROL) delay

DCnnnn - sets ALARM 2 (GPS) delay

DDnnnn - sets ALARM 2 (CONTROL) delay

As noted above, any GPS status failure condition will almost immediately cause a CONTROL status failure, since the control software can only operate in the presence of a GPS 1 pps reference pulse, and without it, will lock the oscillator control voltage to maintain frequency accuracy.

The alarm logic is therefore 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 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 to the operation and setting of the separate alarm delay functions and allows more meaningful use of the CONTROL delay setting.

The programmable alarm delay settings are stored in non-volatile memory; during factory test on new units intended for use with the 1882M distribution unit, they are set as follows:

DA 1 hour) DC 30 sec)
) Alarm 1.) Alarm 2.
DB 1 hour) DD 1 min)
These settings are chosen, in the case of Alarm 1, (Status alarm) to reduce the probability of a spurious alarm triggering the station warning system unnecessarily, with the attendant high cost of response, and in the case of Alarm 2, to signal promptly to the changeover unit that

there is a problem.
For example, if a GPS aerial obscuration should occur, or if severe temporary interference should block reception, then a one hour 'hold-off' is appropriate. Even a CONTROL failure alarm can be delayed significantly for Alarm 1, since the changeover unit (with far shorter hold-offs on Alarm 2) will operate to switch to the standby source.
The Alarm 2 (Changeover Unit alarm) delays are set to force a changeover when the GPS has been in a failure state long enough for the 1 pps timing to be degraded, and when the CONTROL failure has been on long enough to indicate a slower-than-normal recovery from a disturbance.
For other applications the default setting of 5 minutes (012C) for all alarms may be stored. If necessary, check the current delay settings using DA, DB, DC, DD commands as described above.

Settings may be programmed as required to suit unusual conditions which may prevail at certain sites.

APPENDIX A

Frequency & Time Control behaviour.

Frequency.

The frequency control system utilises the units processor and software to provide the intelligence necessary for drift correction of the frequency output.

During initial warm-up from cold, the oscillator control is locked at the last known value which has been stored in non-volatile memory. Sufficient time is allowed (max 2000 seconds) for the crystal oven to approach its designed operating temperature, and during this stage the unit will indicate 'Inactive' status at the control interface, and the front panel CONTROL STATUS indicator will be off.

The software operates intelligently following a power fail and estimates the required oven warm-up time by examining the time since power failure.

During initial warm-up, phase correction routines adjust the reference derived 1Hz into phase alignment with the 1 pps from the GPS receiver, but no corrections are made to the frequency. (CONTROL STATUS indicator will be lit when this alignment has been achieved).
When the GPS receiver has locked on to satellites, a coarse frequency control regime is started during which control voltage changes are made to
drive the reference towards zero error.
The frequency versus time plot for most oven oscillators will show a damped oscillatory characteristic during warm-up; coarse control is appropriate during this phase as the rate-of-change of frequency can be severe. Oven-related variations can extend for several hours following a cold start.

When the frequency measurement algorithms detect that the oscillator is tending to settle into a + 2 in 1010 error band it will adopt the 'Fine'
control mode which limits the rate of correction so that although the period between corrections is maintained, the maximum shift in any period is restricted.
If a change in conditions should occur, such as an abrupt temperature change, or a short-term GPS failure, the software will initiate a return to the 'Coarse' control regime, or even to an 'Inactive' (control locked) mode if necessary.
Under normal installed conditions this does not occur when the GPS data is available.
A remote control command is also available (for testing purposes) to lock the control voltage at its current value.Locking the control voltage will disable the drift correction loop and will cause the CONTROL STATUS indicator to switch off.
It is recommended that at least 24 hours should elapse following initial rack installation for stabilisation of the frequency outputs.

Timing.

Timing data output at power-up is derived from the support clock which provides date and approximate time to aid the GPS receiver in making a fast acquisition; once this has been achieved and the unit is showing 2D or 3D GPS status, the timing data is derived from the satellite data and correct GPS or UTC will be available. The on-time point is indicated by the 1 pps signal from the GPS receiver, which is within 1 microsecond of true time.
When the unit has had sufficient time for the frequency control system to stabilise, the 1pps output at the rear panel provides a better source of on-time indication since it is not subject to the short-term temporal variations associated with the GPS receiver solution.
With satellites in view, and the reference oscillator in a stable state the timing data will remain within + 0.5 microsecond tolerance when using the rear panel 1 pps signal as the on-time marker.

Statement of Compliance (LVD) for 1804

CE

Rapco
ELECTRONICS LIMITED

DECLARATION OF CONFORMITY

We declare that the product(s) listed below meet the safety requirements of the European Commission Directive 73/23/EEC as amended by 93/68/EEC, referred to below as 'The Directive'.

Product(s)	1804 GPS Precision Frequency Source, all versions.

The products identified above meet or exceed the protection requirements of :

EN 61010 -1 Safety requirements for electrical equipment for measurement, control and laboratory use.

The products are defined as Class 1 (earthed) equipment when installed and used in accordance with the instructions in the operators manual.

This equipment is not suitable for use in explosive atmospheres or as a component in a life support system.

..... Date : **27 th JAN'97**

P.L.Baker
Technical Director

for and on behalf of

Rapco Electronics Ltd.

11 Joule Road, Basingstoke, Hants U.K. RG21 6XF

Note : The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use which may apply when the product is taken into service, to maintain compliance with the Directive. The equipment must be installed and used in accordance with all relevant information contained in the product handbook.

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Statement of Compliance (EMC) for 1804L25M

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DECLARATION OF CONFORMITY

We declare that the product(s) listed below meet the electromagnetic compatibility requirements of the European Commission Directive 89/336/EEC as amended by 93/31/EEC and 93/68/EEC, referred to below as 'The Directive'.

Product(s)	1804 M (Mk2) GPS Precision Frequency Source

The products identified above comply with the requirements of the Directive by meeting the following standards :

EN 50081 - 1 E.M.C. Generic Emission Standard Part 1 Residential, Commercial and Light Industry.

EN 50082 - 1 E.M.C. Generic Immunity Standard Part 1 Residential, Commercial and Light Industry.

The technical documentation required to demonstrate that the product meets the requirements of the Directive has been compiled by the signatory below and is available for inspection by the relevant enforcement authorities.

The C E mark was first applied in : **1996**

Date : **17th DEC '96**

P.L.Baker

Technical Director

for and on behalf of

Rapco Electronics Ltd.

11 Joule Road, Basingstoke, Hants U.K. RG21 6XF

Note : The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use which may apply when the product is taken into service, to maintain compliance with the Directive. Details of any such special measures and limitations to use, are, if applicable, contained in the product handbook.

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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.

1. Power Cables

(i) 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.

(ii) d.c. Power

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

2. Signal, Data, or Antenna Cables

Where interconnecting cables are required between RAPCO 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 RAPCO, should be of correct specification and of adequate quality. EMC considerations involving such cables are the users responsibility. Consult RAPCO if informal advice is required regarding choice of cables.

3 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 RAPCO.

(iii) Antenna connectors. In normal applications these will be permanently connected to RAPCO supplied antenna assemblies via RAPCO 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.

Rapco

Equipment Handbook

RAPCO Type 1882M2 Mk2
Auto Changeover/Distribution Unit

Rapco Electronics Limited
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Email: info@rapco.co.uk
http://www.rapco.co.uk

Designed and manufactured in the U.K.

EQUIPMENT HANDBOOK

For

RAPCO Type 1882M2 Mk2

Auto-Changeover/Distribution Unit

Configuration list for this variant:

Dual Reference Frequency inputs

Dual 1Hz Timing inputs

14 x 5MHz Frequency Outputs

2 x 1pps TTL Timing Outputs

50ohm buffers on all outputs

Auto-changeover on Master failure

Front-panel Source-select (manual override) switches

Duplex dc power inputs

Multiple alarm functions (user selectable)

Issue 2 August 2003

CONTENTS

The following additional information is appended at the end of this handbook

ITEMS LISTS

Main Assembly
Sub Assemblies relevant to above

DRAWINGS

3301-5774	-	General Assembly, 1882M2 Mk2 Auto-Changeover/Distribution Unit.
3300-5247 Sht. 1		. 1882M-1/2 ACDU -- Circuit Diagram
3300-5247 Sht. 2		. 1882M-1/2 ACDU 5MHz Section -- Circuit Diagram
3300-5247 Sht. 3		. 1882M-1 ACDU 1 pps Section -- Circuit Diagram
3300-5291 Sht. 1		. 1882M-1/2 d.c./Alarm Cable

SPECIFICATION

Auto Changeover Unit Type 1882M2 Mk2

d.c. Power Supply:

Input Voltage	:	20V - 40V d.c.
Power Loading	:	18W typical

5MHz Buffer Amplifiers

Input Level	:	2.5v peak to peak
Input Impedance	:	180 ohms
Gain	:	Unity
Output Impedance	:	50 ohm

1pps Buffer Amplifiers

Input Level	:	CMOS
Output Pulse Width		20uS $\pm$ 2uS
Output Level `0'		0V - 0.25V
Output Level `1'		2.5V - 5.25V
Output Rise Time		20nS max. (0.25V to 2.5V)
Output Fall Time		100nS max. (2.5V to 0.25V)
Output Impedance	:	50 ohm

Front Panel Controls

5MHz Override Switch	:	Master/Auto/Standby
1 pps Override Switch	:	Master/Auto/Standby

Front Panel Indicators

5MHz Source in Use	:	Master (green), Standby (amber)
1 pps Source in Use	:	Master (green), Standby (amber)
Power	:	Master (green), Standby (green)
Output Fault	:	5MHz (red), 1 pps (red)

Rear Panel Connectors

J1 7-way DIN socket	:	Master Power & Alarm Input
J2 7-way DIN socket	:	Standby Power & Alarm Input
J3 BNC	:	5MHz Master Input
J4 BNC	:	1 pps Master Input
J5 BNC	:	5MHz Standby Input
J6 BNC	:	1 pps Standby Input
J7 BNC	:	1 pps Output
J8 BNC	:	1 pps Output
J9 BNC to J22 BNC inclusive	:	5MHz Outputs (14 off)
J23 BNC	:	Alarm Output

Alarm Output

No Fault	:	Short circuit, volt free contacts.
Fault	:	Open circuit, volt free contacts N.B. Alarm contact configuration can be reversed using internal jumper.

Fault Conditions

	:	Loss of 5MHz Master Input signal
	:	Loss of 1 pps Master Input signal
	:	Loss of 5HMz Standby Input signal
	:	Loss of 1 pps Standby Input signal
	:	Loss of Master Power Input
	:	Loss of Standby Power Input
	:	Loss of any 5MHz Output signal
	:	Loss of any 1 pps Output signal

Fault Definitions

Loss of 5MHz	:	When the signal amplitude falls below 2V peak to peak
Loss of 1 pps	:	When the '0' logic-level rises above +0.25V, or, when the '1' logic-level falls below +2.5V.
Loss of power	:	When the supply voltage falls below 20V.

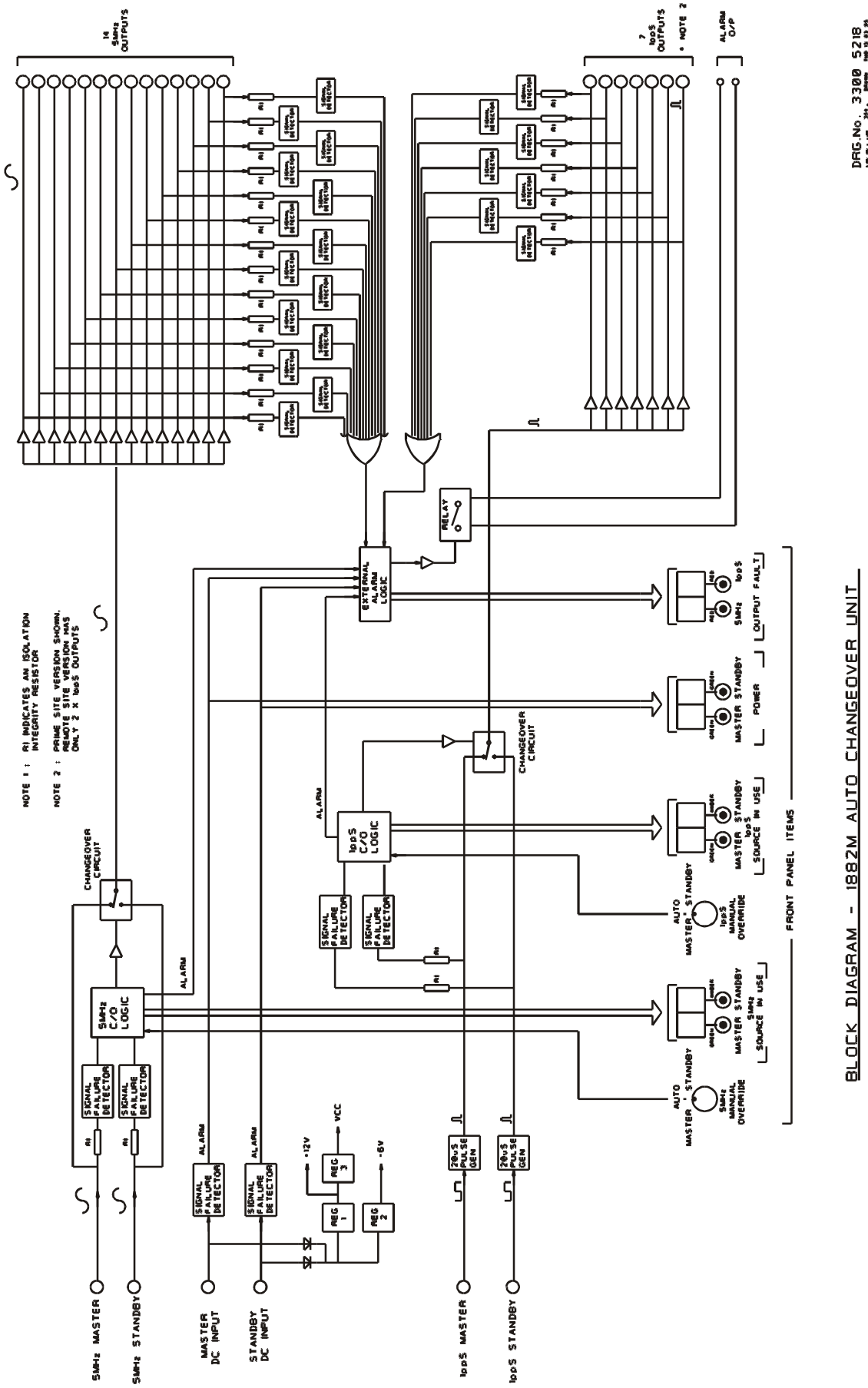
Temperature Range

Operating	:	0^{o}C to 50^{o}C RH 95% (non-condensing)
Storage	:	-40^{o}C to 70^{o}C RH30%

Mechanical

Width	:	483mm
Height	:	44mm
Depth	:	325mm (excluding rear panel components)
Weight	:	3kg
Fixing	:	Standard rack mounting holes.

Drg. No. 3300-5218 Block Diagram 1882



DESCRIPTION

The 1882M2 Auto Changeover Unit provides a switching facility between two 5MHz frequency sources.
The switching can be controlled manually, or the unit can be left to decide for itself when to switch from a faulty source to a good one.

The 1882M2 also provides a switching facility between two 1 pps signal sources. Again, the switch over can be manual or auto, but it is totally independent of the 5MHz signal selection.

If the unit is set to AUTO and is showing 5MHz SOURCE IN USE as MASTER, the unit will automatically switch to STANDBY 5MHz if either the MASTER 5MHz input drops in level to 2V peak to peak or less, or a MASTER alarm signal is received from the MASTER 1804. Once the unit has switched to STANDBY it will remain in that condition even if the MASTER 5MHz were to recover. The MASTER condition would be re-selected if the STANDBY signal were to fail or the OVERRIDE switch was manually set to MASTER. Should the condition exist where both the MASTER and STANDBY signal levels were low, then the 1882 will select MASTER.
The same sequence of events applies to the 1 pps signals except that the alarm levels are different for the digital signals. It should be noted that a 5MHz failure will not cause the 1 pps to switch or vice-versa, but an 1804 alarm will cause both the 5MHz and 1 pps channels to switch over.

The 1882M2 also provides a buffered, isolated, signal distribution function with multiple output connectors (14 x 5MHz and 2 x 1pps signals).

All of the output signals from the 1882M2 are separately buffered by linear amplifiers with an output impedance of 50 ohms, and should therefore, for correct operation, drive 50 ohm loads. The output signals from all outputs are monitored and should any fail, an alarm is generated and a front panel OUTPUT FAULT led will illuminate.

A volt-free contact set also flags a fault via the ALARM CONTACT (J23) connector.
An internal jumper LK1 is normally in position A and provides a short circuit to indicate a no fault condition. Should the user require an alarm to be shown as a short circuit, then the jumper should be placed in position B of LK1. Alarms are generated by the unit for any input signal failure, any output signal failure, or any power input failure.

Operation

Other than the OVERRIDE switches, there are no operator controls on the 1882M. Once the input signal sources have stabilised, the OVERRIDE switches should be set to AUTO and the system can be left to look after itself.

PRECAUTIONARY NOTE:
When connecting the input cable pairs (MASTER and STANDBY) for 5MHz, 1Hz/1pps and d.c. power, double-check that none of these have been accidentally swapped over (i.e. MASTER and STANDBY crossed)
If this error is made, the system *will appear to work normally*, and the problem will only show up at a later time when, if a source fault occurs, there may be a loss of output signals.

Statement of Compliance (LVD) for 1882

CE

Rapco
ELECTRONICS LIMITED

DECLARATION OF CONFORMITY

We declare that the product(s) listed below meet the safety requirements of the European Commission Directive 73/23/EEC as amended by 93/68/EEC, referred to below as 'The Directive'.

Product(s)	ACU Type 1882, 1883 and 1884, all versions.

The products identified above meet or exceed the protection requirements of :

EN 61010 -1 Safety requirements for electrical equipment for measurement, control and laboratory use.

The products are defined as Class 1 (earthed) equipment when installed and used in accordance with the instructions in the operators manual.

This equipment is not suitable for use in explosive atmospheres or as a component in a life support system.

..... Date : .....

P.L.Baker

Technical Director

for and on behalf of

Rapco Electronics Ltd.

11 Joule Road, Basingstoke, Hants U.K. RG21 6XF

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Statement of Compliance (EMC) for 1882

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Product(s)	ACU Type 1882, 1883, 1884 & 1885 (All versions)

The products identified above comply with the requirements of the Directive by meeting the following standards :

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EN 50082 - 1 E.M.C. Generic Immunity Standard Part 1 Residential, Commercial and Light Industry.

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The C E mark was first applied in : **1997**

..... Date : **12th FEB' 97**

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ELECTROMAGNETIC COMPATIBILITY NOTES

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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 RAPCO equipment are intended only for direct connection to other RAPCO units, normally mounted in adjacent, or near adjacent, positions. The only approved cables for these purposes are those supplied by RAPCO.

Signal, Data, or Aerial Cables

Where interconnecting cables are required between RAPCO 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 which interconnect with the users equipment and not supplied by RAPCO, should be of correct specification and of adequate quality. EMC considerations involving such cables are the users responsibility. Consult RAPCO 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 RAPCO.

(iii) Aerial connectors. In normal applications these will be permanently connected to RAPCO supplied aerial assemblies via RAPCO cables. In the unlikely event that a unit is to be installed without the aerial cables connected, protection in the form discussed above for data cables is recommended. Note that where equipment is configured for use with an active aerial, 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.