SECTION THREE : OPERATION

3.1 CONTROLS

The following should be read in conjunction with the front panel drawing BP2028 bound in Part 2.
The 1650/6 features a membrane front panel switch array with LED indication and three rotary controls. Only certain functions of the membrane front panel switch are used in the receiver and these are described below, the remainder are non-operative.

ON/ST BY — Turns the receiver on and illuminates the display and front panel control indicators. No operation is possible with the receiver in standby mode.

0 - 9 — Numeric keys 0-9 enter the frequency, most significant digit first, on the eight digit LED display. All trailing digits must be entered for the correct tuned frequency.

AGC — The AGC key selects Slow, Fast, Off.....Slow etc. with each key press, the setting is indicated by orange LED.

SELECTIVITY — One of three bandwidths is selected by 'up and down' keys, either 3kHz, 8kHz, 16kHz.....3kHz etc. or the reverse with the other key pressed. The selectivity is indicated by orange LED.

METER — The METER key selects CZ, AF, RF1, RF2.....CZ etc. with each key press, the setting being indicated by green LED while the level is shown on a 10 LED bargraph. RF1 indicates the RF AGC voltage and RF2 the IF AGC voltage. AF displays line output level at 10mW. CZ is not used.

IF GAIN — The IF gain control is only operative with the AGC switched off. Clockwise rotation provides maximum gain.

AF GAIN — The AF gain control adjusts the 8 ohm AF output to an external loudspeaker or a headset (when connected to the Phones jack socket). Clockwise rotation provides maximum gain.

LINE LEVEL The line level preset control adjusts the 600 ohm isolated AF output to external lines. It may be preset, with a suitable tool, via the front panel access. Clockwise rotation provides maximum gain.

3.2 LOCAL OPERATION

The receiver should be set up as described in SECTION TWO : INSTALLATION and the power applied.
If the receiver is in standby mode then the LED digital display will first show 'reset' for one second and then only the oven LED will remain on. Pressing ON/ST BY will turn the receiver on and illuminate the display.
If the receiver is not in standby mode then the LED digital display will first show 'reset' for one second and then revert to the tune frequency.
The receiver is now ready to be adjusted to the required frequency and signal level. This is shown in the following examples :-

Example 3.1
To tune to 1000kHz

Press <0>, <1>, <0>, <0>, <0>, <0>, <0>.

After entering the most significant or leading zero the display will show :-

0 - - - -.- - 0

Subsequent key entries fill the display clearing all the 'bars' and blanking leading zeros :-

1 0 0 0.0 0 0

N.B. The frequency is only entered to an accuracy of 10Hz.

Example 3.2
To tune to 10MHz

Press <1>, <0>, <0>, <0>, <0>, <0>, <0>.

After entering the most significant digit the display will show :-

1 - - - -.- - 0

Subsequent key entries fill the display clearing all the 'bars' :-

1 0 0 0 0.0 0 0

AGC and Selectivity settings are indicated by the relevant LED pointer and are 'stepped through' by repeated key presses.

Example 3.3
To set AGC Fast and Selectivity 3kHz.

Press <AGC>, repeatedly until LED pointer shows Fast AGC :-

AUDIO
SLOW
FAST *
OFF

Press <SELECTIVITY> (either key) repeatedly until LED pointer shows 3kHz :-

16kHz

8kHz

3kHz *

3.3 REMOTE OPERATION

Remote control operation is via the 'REMOTE connector' (1) PL1 detailed in Figure 2.3.
The system uses serial synchronous data transfer at 1200 to 4800 bits per second to interrogate the receiver status and to control tuned frequency, selectivity, AGC fast or slow and Wideband on/off.
Connection of the 'remote control' automatically switches the receiver to remote operation and illuminates the green Remote LED. The front panel membrane switch is locked out during remote operation.

Error protection is provided in three ways:

a) By providing a CHECKSUM code with each data transfer (see 'CODES').

b) By providing a fixed two bit sequence at the start of each word. (see 'THE SERIAL WORD').

c) By reverting the data word received back to the controller to enable bit by bit comparison. Note data is only reverted if it passes checks (a) and (b) at the receiver and thus has been used to alter settings etc. Any failure to revert data back after approximately 25mS plus two line delays and a word period indicates that either the receiver did not receive the data or did not receive it correctly or that there was a line failure in one or both directions. In all cases a check of system and settings should be made by use of the interrogation code (see 'CODES').

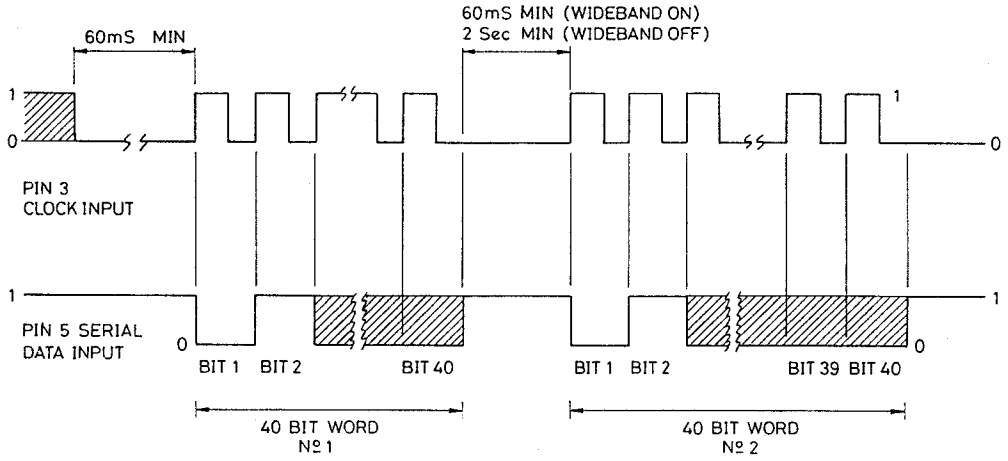
All serially controllable settings are made simultaneously with just one code transmission (see CODES). The 5Hz digit is automatically set to 0Hz when remote operation is selected and the meter setting stays as selected under local control.

3.3.1 THE SERIAL WORD

INPUTS

The serial control inputs are in the form shown in Figure 3.2

Figure 3.2
Data Inputs



Each word is 40 bits long , the first bit transmitted (bit 1) is always '0' and the second bit (bit 2) is always '1'. Bits are sampled by the receiver on the falling edge of the clock input (see Figure 3.2). The receiver will not accept or revert any data in which bits 1 and 2 are not as described.

In normal remote use, when data is not being sent, the clock line is maintained low. It is this that keeps the receiver in remote control mode, locking out the keyboard and looking for a serial word input. The clock line must be low for at least 60mS before the first word is transmitted and should ideally be kept low between words to ensure rapid frequency switching (of the order of 50mS). Gaps of at least 60mS should be left between words if 'Wideband' operation is selected or at least two seconds if 'Wideband' is deselected (i.e. the narrow RF preselector has been installed). In the latter case 'Wideband' operation is automatically selected until the preselector is brought onto tune (which takes one to two seconds maximum).

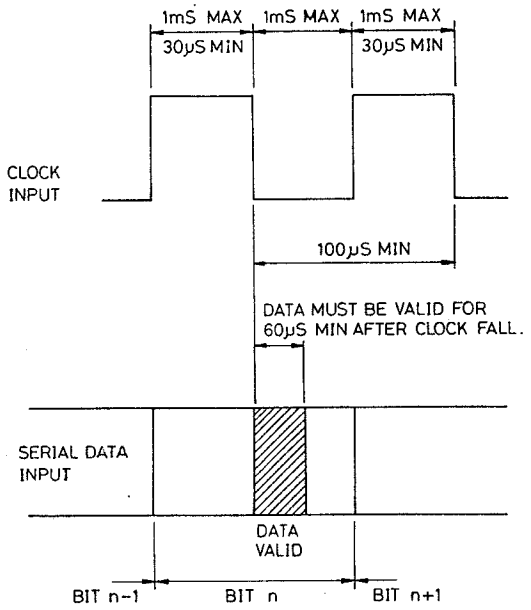
OUTPUTS

These are of the same form as the 'INPUTS' except that the clock line is held in the high '1' state between words. The output is only generated in response to an input and starts about 25mS maximum after the end of an input word. The output clock has a 1:1 mark-space ratio with the low going edge half way through the data bit. An output bit rate of 1200Bps, 2400Bps or 4800Bps is selected automatically by measuring the corresponding clock input period and selecting the nearest available output rate.

3.3.2 INPUT BIT DETAIL

Timing of the individual bits is shown in Figure 3.3

Figure 3.3
INDIVIDUAL BIT TIMING



The following conditions at the remote connector input (1) PL1 must apply for reliable operation.

i) Data must be valid for 60uS minimum on and after the falling edge of the clock.

ii) The maximum clock/data input period is 2mS (1:1 mark-space ratio on clock line). This gives an absolute minimum bit rate of approximately 600Bps (n.b. reverted data would still be at 1200Bps).

iii) The minimum period between successive falling edges is 100uS which, combined with (i) gives a maximum bit input rate of approximately 9600Bps (N.B. reverted data would still be at 4800Bps).

iv) The minimum clock high period is 30 uS.

The input bit rate accuracy is not generally important since data bit sampling is synchronised to the clock and thus any input rate between 600Bps and 9600Bps is satisfactory as long as conditions (i) to (iv) are met at the remote connector (1) PL1. The output data rate however is only at 1200Bps, 2400Bps or 4800Bps, whichever is closest to the input bit period.

3.3.3 CODES

The format of the data word both (control and revertive) are as follows in order of transmission (i.e. bit 1 first)

Bit 1	Always '0'	
Bit 2	Always '1'	
Bit 3	Revert/ *	
Bit 4	Selectivity	
Bit 5	LSB	
Bit 6	...	10Hz
Bit 7	...	
Bit 8	MSB	
Bit 9	LSB	
Bit 10	...	100Hz
Bit 11	...	
Bit 12	MSB	
Bit 13	LSB	
Bit 14	...	1kHz
Bit 15	...	
Bit 16	MSB	
Bit 17	LSB	
Bit 18	...	10kHz
Bit 19	...	
Bit 20	MSB	
Bit 21	LSB	
Bit 22	...	100kHz
Bit 23	...	
Bit 24	MSB	

Bit 25	LSB	)	
Bit 26	...	)	1MHz
Bit 27	...	)	
Bit 28	MSB	)	
Bit 29	LSB	)	
Bit 30	MSB	)	10MHz
Bit 31	Wideband	'1' for 'ON' '0' for 'OFF'	
Bit 32	AGC	'1' for 'FAST' '0' for 'SLOW'	
Bit 33	EXCLUSIVE 'OR' of bits 1,9,17,25		
Bit 34	EXCLUSIVE 'OR' of bits 2,10,18,26		
Bit 35	EXCLUSIVE 'OR' of bits 3,11,19,27		
Bit 36	EXCLUSIVE 'OR' of bits 4,12,20,28		
Bit 37	EXCLUSIVE 'OR' of bits 5,13,21,29		
Bit 38	EXCLUSIVE 'OR' of bits 6,14,22,30		
Bit 39	EXCLUSIVE 'OR' of bits 7,15,23,31		
Bit 40	EXCLUSIVE 'OR' of bits 8,16,24,32		

* BITS	4	3
REVERT ONLY	1	1
16kHz	1	0
8kHz	0	1
3kHz	0	0

NOTES

i) Frequency settings are sent in B.C.D form. Any digits greater than 9 sent are interpreted by the receiver as '9' but are reverted for comparison checking purposes as the actual digit received. In the case of 10MHz, if '3' is sent, it is interpreted as '2' but reverted as '3' etc.

ii) The last eight bits are an Exclusive OR error checksum. If the 40 bits are considered as a vertical block of 5 bytes, this checksum is a 'vertical' even parity check.

iii) If bits 3 and 4 are both '1', then the present settings of the receiver are reverted to the controller for a status check. No change in settings will occur at the receiver. As long as bits 1, 2 are '0', '1' respectively and the checksum is correct, then the settings of the other 28 bits are not important. Note that data returned to the controller can only be checked for a leading '0', '1' and a correct checksum since bit by bit comparison with the 'revert only' command is obviously not possible.This contrasts with setting commands which need only perform bit by bit comparison of the data reverted with that sent (since a leading '0', '1' and a correct checksum are already present in the data sent).