

DIAGRAM NOTES AT/ATW 622780, PART THREE

SPECIFICATION T 62278

EQUIPMENT PULSE GENERATING NO. 2A/2B

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1.

GENERAL

1.1 Diagram Notes AT/ATW 622780 are contained in three parts:-

PART 1 - is a detailed hardware description restricted to headquarters and regional repair centres.

PART 2 - is a detailed software description restricted to headquarters and regional repair centres.

PART 3 - is an outline circuit description and operating instructions on General Distribution.

1.2 This diagram shows the circuit of the Equipment Pulse Generating No. 2A/2B used at analogue and UXD exchanges for local tariff control.

There are two versions of the software:

Version 1.0 is fitted to EPG 2A's forming part of the Equipment Pulse Generating No. 2C which is provided at Group Switching Centres (GSC's) and Sector Switching Centres (SSC's). The EPROM's, IC3 and IC4, are labelled 'EPG 2C, V1.0'.

Version 3.0 is fitted to the following:-

(i) EPG 2A's forming part of Pulse Generator Equipment No. 5A which is associated with Multiphase Pulse Supply Equipment at large local analogue exchanges.

(ii) Single EPG 2A's at small local analogue exchanges.

(iii) Single EPG 2B's at UXD exchanges.

The EPROM's are labelled 'V3.0'.

The versions differ only in the ORD and CCB rates output when the EPG is in the alarm state ie the rates held in FTD1. Version 1.0 - pulse interval 90 seconds, version 3.0 - pulse interval 54 seconds. Both give a 9 minute rate at the exchange.

When EPG 2A's are maintenance exchanged care should be taken to ensure that the correct EPROM's are fitted.

The diagram should be considered in conjunction with the following diagrams or equivalent.

AT 60054	PULSE SUPPLY MONITORING RELAY SET UAX 12.
AT 60078	PULSE SUPPLY MONITORING RELAY SET UAX 13.
AT 60105	PULSE SUPPLY MONITORING RELAY SET UAX 14.
AT 71637	PULSE SUPPLY MONITORING TXE 2 (PTL)
AT 714680	PULSE SUPPLY MONITORING TXE 2 (STC/GEC)
AT/ATW 627310	PULSE GENERATOR EQUIPMENT NO. 5A
AT/ATW 627320	PULSE GENERATOR EQUIPMENT NO. 5A. AUTO CHANGEOVER UNIT
AT/ATW 627330	AMPLIFIER NO. 238A
AT/ATW 627350	EQUIPMENT PULSE GENERATING NO. 2C.

2.

FACILITY SCHEDULE

Provision is made for:-

- 2.1 Four output pulse supplies of 250 ms in duration.
- 2.2 Midnight line switching.
- 2.3 An alarm output under fault conditions.
- 2.4 Monitoring of five output leads.
- 2.5 A processor manual reset.
- 2.6 Clock frequency measurement.
- 2.7 Environmental temperature control.
- 2.8 Analogue monitoring of the one second pulse supply.
- 2.9 A predetermined change of pulse supply outputs in accordance with Fixed Tariff Data (FTD).
- 2.10 A record of a fixed tariff data change.
- 2.11 Day program numbers to be displayed.
- 2.12 An indication of the pulse supply rates.
- 2.13 A display of the tariff pattern.

- 2.14 Pulse supply rates in force display.
- 2.15 Alarm error number to be displayed for analysis.
- 2.16 Date display.
- 2.17 Alarm latch and LED display check.
- 2.18 Time display.
- 2.19 Temporary pulse supply pattern changes through the amendment table.
- 2.20 Byte-checksum display for edited fixed tariff data.
- 2.21 Clearing the display and alarm hardware.
- 2.22 Editing fixed tariff data.
- 2.23 Displaying a final checksum when editing is finished.
- 2.24 Giving coded Call Revenue Apportionment Measurement (CRAM) outputs to indicate tariff periods appertaining to the ORD supply.

3.

CIRCUIT DESCRIPTION - OUTLINE

3.1 This equipment is a micro-processor system which provides tariff control facilities for local timing at analogue exchanges and UXD's.

The circuit is built on a single printed wiring board and comprises of the basic 8085 micro-processor system, containing the 8085 micro-processor (IC 1), the 8156 256 Byte Ram (Random Access Memory IC 2) with timer and two input/output ports (IO), and two 8755 2 kbyte EPROM's (erasable programmable read only memory) with two IO ports (IC 3 and 4).

Timing is derived from a 5 MHz oscillator and the CPU is interrupted every 1 ms from the RAM timer.

Four output pulse supplies are produced plus an alarm facility, a midnight line facility and two leads to indicate the tariff in force (CRAM leads). The pulse supplies are one second, ORD, CCB and 24 hour pulse. The software allows for regular changes of pulse supply rates according to a pre-determined set of Fixed Tariff Data (FTD) in EPROM or RAM.

The one second output is monitored by means of monostable circuits for missing or extra pulses and five pulse supplies are read back at exchange voltage levels for monitoring of FTD.

Information updates such as editing and amendments are entered using the keyboard. This has sixteen individual outputs which are scanned by software and the seven segment displays are software controlled.

The unit will recognise calendar dates up to the year 2079 without reprogramming using the current date as a base.

The exchange -50 volt supply is converted to a +5 volt supply via an on-board d.c./d.c. converter for integrated circuit voltage levels.

4.

PULSE SUPPLY OUTPUTS

4.1 Pulse supply outputs are 250 ms earth pulses, each output can sink up to 40 mA but larger loads may be accommodated by connecting drivers in parallel (IC 9 and 10). The outputs are protected by diodes Z1-Z8.

4.2 The midnight line output is a disconnection between 0000 hrs and 0600 hrs. Conditions are otherwise as pulse supply outputs.

4.3 The alarm output is normally a disconnection when an alarm is being given. AL relay releases and AL1 contact releasing operates the rack alarm. Under no alarm conditions relay AL is permanently operated. Alarm polarity may be reversed by a wire link option, conditions are otherwise as pulse supply outputs.

4.4 Earths on the CRAM leads indicate the tariff in force on the ORD supply.

Earth on PL2 (SCA 8) - Peak rate
" " PL7 (SCA 6) - Standard rate
" " PL2 and PL7 - Cheap rate

4.5 The 24 hour pulse is a 250 ms earth pulse at 1300 hours.

5.

INPUT CONDITIONS

5.1 The pulse supply outputs are fed back into five level converters for monitoring, each of which may be strapped to make a disconnection look like either -50 V or 0 V as required (S1-S5).

Straps S3-S5 are always provided. Straps S1 and S2 must be provided when the EPG 2A forms part of Equipment Pulse Generating No. 2C or Pulse Generator Equipment No. 5A.

6.

TEMPERATURE CONTROL

6.1 Resistors R3 and R4 may be used as heaters at sites where the temperature may fall below the working range of the micro-processor (0-70 degrees centigrade).

7.

POWER SUPPLY

7.1 A -50 V/+5 V d.c./d.c. converter is mounted on the printed wiring board; the exchange earth and logic 0 volts are run separately on the PWB and commoned on the tag block.

7.2 A -50 V supply fused at 1 amp is required, the maximum current drawn is 230 mA.

8.

SYSTEM FUNCTIONS

8.1 The software allows for regular changes of pulse supply rates according to a predetermined set of Fixed Tariff Data (FTD) in EPROM or in RAM. These regular changes may be modified by means of entries in the amendment list entered up to 12 months in advance via the keyboard. These entries specify which pattern of tariff rate changes should apply on a particular date instead of the predetermined one.

8.2 Tariff revisions are catered for by means of a Works Specification. This will detail changes to a copy of FTD held in RAM which is brought into use from a pre-determined date.

8.3 On startup, or if certain faults are detected the equipment outputs a fixed rate (9 minutes at the exchange) for CSH purposes until the time and date are input.

8.4 Changes from and to BRITISH SUMMERTIME may also be preprogrammed in the amendment list up to 12 months in advance, but there is space for only 16 entries in the list. The amendment list is also lost if the power fails or if the equipment fails and has to be restarted.

9.

ALARMS

9.1 Some detected faults give rise to alarm numbers which may be displayed on demand from the keyboard. However, since the majority of the hardware is required to work to provide the keyboard and display function, error numbers are only provided for faults detected in pulse supply outputs and code check sum errors.

9.2 ERROR NUMBER	FAULT
2	PULSE SUPPLY 2 (ORD) FAIL
4	PULSE SUPPLY 3 (CCB) FAIL
8	PULSE SUPPLY 4 (CRAM) FAIL
16	PULSE SUPPLY 5 (CRAM) FAIL
32	PULSE SUPPLY 6 (24 HR) FAIL

If more than one pulse supply fails the alarm error number will be cumulative total.

40	TOO SLOW
41	PROM 1 ERROR
42	PROM 2 ERROR
43	RAM ERROR
44	HARDWARE ERROR
88	ALARM CHECK

10.

SELF TESTS

10.1 Every half-hour and on demand the coded EPROM's and the copy in RAM of the FTD is checksummed and compared with a stored value. When a tariff revision is implemented by changing a copy of the current FTD it should have its checksum displayed and compared with the Works Specification by operating Key 'B'.

11.

OPERATING INSTRUCTIONS

11.1 Command Formats

The format of commands is as follows:-

FUNCTION	SUBFUNCTION /DAY PROGRAM /PS NO.	PULSE SUPPLY NO. TARIFF PATTERN
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11.1.1 Function

FUNCTION	MEANING	COMMENT
A	AMEND	Amend data displayed.
B	BYTE CHECKSUM	Display checksum of FTD being edited.
C	CLEAR	Clear display and alarm hardware.
D	DISPLAY	Put equipment into display mode.
E	EDIT	Copy FTD from EPROM to RAM and enter edit mode.
F	FINISH	Finish editing, display final checksum.

11.1.2 Subfunction

Function D has the following subfunctions:-

SUBFUNCTION	MEANING
0	Display time eg 12.30.55
1	Display amendment table entry
2	Display tariff dates eg 80.01.01
3	Display day program numbers
4	Display rates
5	Display tariff pattern
6	Display rate in force
7	Display any alarm details
8	Display date eg 81.08.11
9	Display 8 8 8 8 8 8 and set alarm on.

11.1.2.1 Display Time

Key D0 to display the time which is updated every second. This display should be left on the equipment to give a ready indication that it is functioning. To change the time, key A, the display will stop incrementing and flash, and the new time should be entered.

Note that the new information replaces the old as soon as the last character is entered, so this should be entered only with reference to the speaking clock or equivalent time reference.

NOTE:- Do not change the time to or from 23.59.00 and midnight, this would prevent the date flag from being set, and the amendment table from being cleared.

11.1.2.2 Display Amendment Table entry

Key D1, the date of the first entry is displayed, key 1 again to cause the pulse supply number and function number applying on that date to be displayed.

Key 1 again for the next entry, etc. The date order of entries is unimportant. After displaying the 16th entry the first is again displayed.

FUNCTION NUMBER	MEANING
0	Clear entry
1	Tariff pattern 1 applies (weekday pattern)
2	Tariff pattern 2 applies (weekend pattern)
3	Tariff pattern 3 applies
4	Tariff pattern 4 applies
15	Change to BST at 01.00 HRS GMT
16	Change from BST at 02.00 HRS BST

Functions 3 and 4 would only be used if a tariff pattern different from 1 or 2 were needed.

11.1.2.2.1 Adding Amendments

Key D1 to display the amendment table. The display will indicate the entry number 1-16, and then 0000. Key A, the first '0' will flash. Enter the required month and day. Entries are limited to a 12 month period.

The display will now flash the Pulse Supply Number. For tariff patterns enter the pulse supply number followed by the function number;

eg 2 Pulse supply 2 (ORD)
2 Tariff pattern 2 (Weekend)

Result - cheap rate all day on ORD supply.

For BST-GMT and GMT-BST changes enter the function number eg 16. The clock will advance or retard by one hour on the amendment date.

All entries should be displayed again for verification.

To delete an entry 0000 should be entered. Entries are deleted automatically when used.

11.1.2.3 Display Tariff Change Date

The EPROM contains two sets of Fixed Tariff Data (FTD).

FTD0 contains test rates and is dated 80 01 01.

		ORD	CCB
Test rate	cheap	3 seconds	6 seconds
	medium	2 "	5 "
	peak	1 "	4 "

FTD1 contains the fall back rates which apply when the EPG is in the alarm state or if tariff rates are not inserted when the EPG is programmed.

FTD1 is dated 81.11.02.

The rates for both ORD and CCB outputs are:-

Version 1.0 software	90 seconds
Version 3.0 "	54 "

Two further FTD's, FTD2 and 3 are held in RAM and contain the date the EPG was programmed and possibly a future revision date. These dates will not necessarily be in the order FTD2, FTD3.

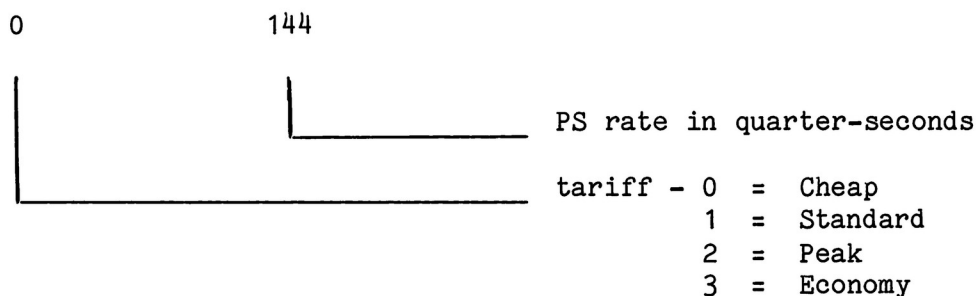
To display the dates key D2. FTD0 date will be displayed. Key 2 repeatedly to display the dates for FTD1-3.

11.1.2.4 Display Day Program Numbers

Key 3 and then the required pulse supply number 2 for ORD, 3 for CCB, to display the day program numbers. The display will indicate the first four days' program numbers MONDAY to THURSDAY ie 1111, key 3 again to display day numbers five to seven FRIDAY to SUNDAY ie 122. Note the current day program number may have been modified by an entry in the amendment table.

11.1.2.5 Display Rates

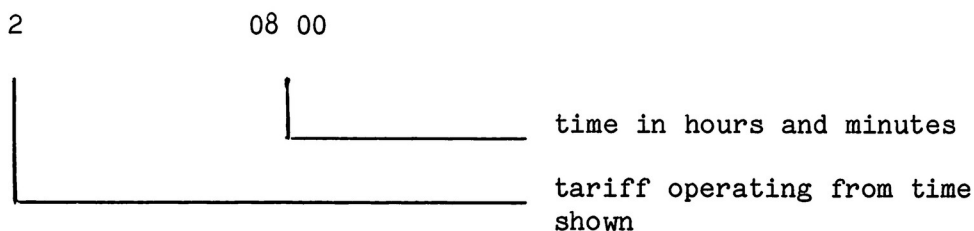
Key D4 followed by the pulse supply number (1-3), the display is as follows:-



Note that the exchange multiplies this rate by ten in local exchanges and by six in GSC's and SSC's. Key 4 again to display the rate of each tariff in turn.

11.1.2.6 Display Tariff Pattern

Key D5 and the day program number (ie 1 = WEEKDAY : 2 = SAT/SUN : 3 = UNSPECIFIED : 4 UNSPECIFIED : 5 MIDNIGHT LINE) to display the first of the six tariff pattern times. Key 5 again to display the next line and so on. The display is as follows:-



For midnight line, period 0 is the disconnection ON time and 1 the earth ON time.

11.1.2.7 Display Rate in Force

Key D6 followed by the pulse supply number, to indicate the rate in force at the current time of that supply. It should be noted that when a tariff changes from a high value to a lower one, it does so one minute before its designated time, and similarly when going from a low value to a higher one, the tariff changes over one minute after the designated time.

11.1.2.8 Display Alarm Details

Key D7, if any alarms are present, the display will indicate an error value which represents an area of fault (para 9.2 refers). To clear the display and reset the alarm hardware, operate key C.

11.1.2.9 Display Date

Key D8 to display. The date can only be entered on startup.

11.1.2.10 Alarm Check

Sub-function D9 causes 888888 to be written on the display and the alarm hardware alarm latch to be set. It acts as a lamps test of the display and a confidence check on the alarm hardware. Sub-function D7, to display alarms will display alarm number 88. Key C to clear.

11.1.3 Editing New FTD

11.1.3.1 FTD may be edited in advance of a tariff change to be brought into use on a date entered in the FTD. The procedure for so doing will normally be contained in a works specification to be applied in advance or on coldstart before entering the time. The editing of FTD is protected by a security code, ¹key **** which copies the latest EPROM copy of FTD into RAM. Amend in a manner similar to that described in Paragraph 11.1.3.2 for amending a tariff pattern. When complete key B and compare the display with the checksum shown in the works specification. If correct key F, otherwise recheck. The entry may be verified by keying D2 to display the tariff change date.

11.1.3.2 Editing a New Tariff Pattern

Having entered the edit mode, key D5 (1-5) followed by 5 repeatedly until the desired line is displayed. Key A when the display will flash, and enter the whole line again. Key 5 if required for another line followed by A and enter a whole line as above. Note entries must be in ascending order of time and the last entry must be repeated to fill all unused entries.

eg	1	0800
	2	0900
	1	1300
	0	1800
	0	1800
	0	1800

Always display the whole tariff pattern following any changes to verify.

11.1.4 Starting from Cold

On start up the display will flash 000000 until the date, any amendment table entry, and any FTD editing have been entered. The time is entered in the normal way. Operation of Key C clears the initial alarms.

The system should now be running and this can be verified by displaying the time, the rate in force and noting the absence of alarms.

¹ The security code will be contained in the works specification when necessary.

12.1 Two clock test pins are provided to measure the frequency of the oscillator. This should read half frequency $2.5 \text{ MHz} \pm 5 \text{ Hz}$.

12.1.1 Two reset pins are provided, short circuiting manually resets the micro-processor.

12.1.2 Two alarm modes are provided which by suitable strapping can change the alarm output to an earth or disconnection as required. The normal output from the PWB is disconnection and this strap is included in the tracking.

12.1.3 Straps S1-S5 when provided, supply exchange voltage levels to the monitor inputs to satisfy pulse check. When S1 and S2 are omitted, the load provides the pulse check input level, and the unit will alarm in its absence.

12.2 Zener Diodes

- | | |
|--------------|--|
| 12.2.1 Z1-Z8 | Connected to the outputs of IC9 and 10 for protection against large spurious voltages. |
| Z9 | Prevents excess voltage reaching the d.c./d.c. converter and against accidental supply reversal. |
| Z10 | Maintains a -31 V supply to IC9 and 10 for -VCC input. |

12.3 Capacitors

- | | |
|-----------------------|---|
| 12.3.1 C1-C11 and C13 | are 50 V decoupling capacitors |
| C14 and C15 | in conjunction with R5 and 6 provide RC network for monostable timers. |
| C16 and C17 | are decouplers for the timers voltage control. |
| C12 | acts as a d.c. block on the timer trigger input. |
| C18 | in conjunction with R10 holds RESET low until the supply voltage (VCC) has been established for 500 μs . |
| C19 | is a decoupler across the +5 V supply. |
| C20 | prevents immediate -50 V decay in the event of an interruption to the exchange voltage supply. |

12.4 Resistors

- | | |
|------------------|--|
| 12.4.1 R1 and R2 | act as current limiters for decimal point display. |
| R3 and R4 | function, when required as the heater circuit. |
| R7 and R8 | pull up resistors for timer. |
| R9 | pull up resistor for READY input to micro-processor. |

- R11 current limiter for relay drivers.
- R12 pull up resistor for alarm latch.
- R13 when required acts as an external bias for the crystal oscillator.

12.5 Resistor Packs

- 12.5.1 RP1 and 2 pull up resistors for keypad.
- RP3 current limiters for seven segment LED.
- RP4 and 5 provide the base operating current for the LED display transistor drivers.
- RP6, 7 & 8 In conjunction with D1-D10 act as the level converters for the five pulse supply inputs.

12.6 Diodes

- 12.6.1 Diodes D1-D10 In conjunction with RP6, 7 and 8 act as level converters for the five pulse supply inputs.
- D11 Prevents excess voltages reaching the timer circuit.
- D12 In conjunction with C20 protects the circuit against immediate exchange power failure.

13.

HISTORY

Issue		Date	Remarks
Dgm	Notes		
1	1	May 1982	
3	1	September 1987	Pulse resolution increased to 0.25 sec. Tariff pattern data increased amendment entries decreased to 16. Two versions of software introduced.

British Telecommunications Headquarters
 LNS02.5.1/MB
 203 High Holborn
 LONDON WC1

END OF DIAGRAM NOTES