

PCB 75015 and PCB 75019

12.1 Introduction

The front panel holds the analogue meter, the Switch Encoder/Display PCB and the D6 Switch PCB. The Switch Encoder/Display PCB incorporates the following sub-circuits:

- 10-character alphanumeric vacuum fluorescent display, driver, and filament supply inverter;
- 24 front-panel LED display driver circuits, controlled from the D0-D7 data bus and three chip-select lines;
- switch encoder for the 22 front panel pushbuttons and the three rotary switches, giving the switch data output as one bit.

12.2 Circuit Description

12.2.1 Vacuum Fluorescent Display

The RESET, DATA and CLOCK lines provide the inputs for the display controller, IC2.

TR1, 2 and 3 are non-inverting level shifters from the 5 V logic levels of the microcomputer to the +15 V required by the VFD controller, IC2.

The RESET input provides the master reset for IC2 immediately on power-up.

The DATA input is applied to IC2, and then a short pulse is applied on the CLOCK input. The monostable, IC7, has a period of about 1.2 μ s. It serves to limit the duration of the positive-going CLOCK pulse, if the operating programme is interrupted. The pulse must not exceed 20 μ s at IC2.

IC8 functions as a free-running oscillator at about 40 kHz. Its output is fed to transformer T1, which transforms the output to 3.9 V RMS in order to heat the filaments of the vacuum fluorescent display. R3 and D24 bias the filament supply at about -12 V DC. Unlit segments have their anodes and/or grids biased to -18 V by resistors RN2-RN4, R18 and R19 in order to ensure they are turned off fully.

The display is multiplex driven by IC2. In order to light a segment of a character, both the grid (i.e. the character position), which is one of pins 10 to 19 of the display, and the anode (i.e. the segment), which is one of pins 2 to 9 or 20 to 27 of the display, must be at +15 V. This process runs repetitively at nominally 50 kHz.

IC1, a 7815 voltage regulator, supplies the power to IC2.

12.2.2 LED drivers

IC12, IC13 and IC14 are 8-bit D-type latches on the I/O bus of the microcomputer (see section 3). They are clocked by output strobe lines from the microcomputer. IC9, IC10 and IC11 are inverting Darlington drivers to boost the current to drive the LEDs, D1 to D23 and D25. A logic 1 on the I/O bus is latched as a logic 1 on the output of IC12-IC14, and causes a low voltage on the output of IC9-IC11.

12.2.3 Switch Encoder

IC5 is an 8-bit D-type latch on the I/O bus of the microcomputer, clocked by one of the output strobe lines (see section 3). The lower four bits of its outputs are applied to IC4, a 1-of-16 decoder. These outputs in turn are fed to a 16-by-8 matrix of switch contacts.

The 8 lines returning from the matrix are fed to IC6, a 1-of-8 multiplexer, whose three select lines are fed from bits 4 to 6 of the output of IC5.

The overall result is that the state of one of up to 128 (=16x8) switch contacts is presented to the microcomputer from pin 14 of IC6.

12.3 Removal/Disassembly/Replacement

12.3.1 Removal of Front Panel

Remove six screws retaining the Front Panel Assembly to the instrument chassis.

Unplug the ribbon cable from the top connector of the microcomputer assembly.
Unplug the cable assembly from the Motherboard.

12.3.2 Removal of PCBs

Prise off yellow knob caps.

Using an 8mm A/F socket spanner, turn the collet nuts $\frac{1}{2}$ - 1 turn anti-clockwise.

Slide knobs off shafts.

Using a 13mm A/F deep socket spanner, remove the switch nuts and shakeproof washers. Do NOT use pliers; you will almost certainly scratch the front panel when they slip!

Turn front panel assembly over and remove two screws at top securing PCB 75019 to front panel.

Remove the 11 M3 nuts and insulating washers securing PCB75015.

Lift PCBs carefully away from front panel.

In some cases, individual wires connect the main PCB to the subsidiary D6 switch PCB. Take care not to flex these repeatedly to prevent possible interconnect failure.

12.3.3 LED Replacement

Clip the faulty LED leads and remove.

Carefully extract each LED lead taking care not to damage plated through holes or delaminate the PCB.

Clean mounting holes of solder.

Orient LEDs as shown in Figure 12.3.1.

Insert into PCB but DO NOT SOLDER YET.

Replace both PCBs as Section 12.3.8.

Insert LED through front panel as shown on the drawing (also to match others on the unit).

Solder in place and crop leads.

12.3.4 D6 Switch Replacement

Remove the cap from the offending switch.

Clip off the leads as near the switch body as possible.

Desolder and remove leads from the PCB.

Clean out mounting holes.

Orient switch as shown in Figure 12.3.2.

Insert into PCB and ensure that it is flush and square on the PCB.

Resolder. Inspect and level if necessary.

Replace both PCBs as in Section 12.3.8.

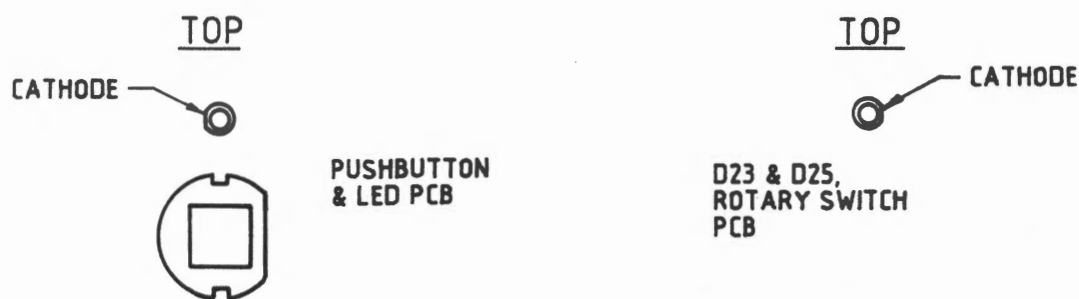


Figure 12.3.1 Orientation of LEDs and D6 Switches

12.3.5 Vacuum Fluorescent Display Replacement

Clip all display leads.

On rear of PCB depress retaining lug on mounting pillars and remove the faulty display.

Desolder and remove leads and clean holes.

The replacement display comes with 2 mounting pillars.

Bend display leads at right angles, similarly to the old display.

Ensure that the rear face of the display is perfectly clean, with not even a fingermark on it, since any dirt or fingermarks can greatly reduce the strength of the adhesive bond. Use methylated spirit or a similar solvent cleaner if necessary. Do NOT use white spirit, which is greasy in nature. Remove the protective paper from the double sided tape on the top of the pillar.

Carefully align each pillar with one end of the display and stick it on carefully. (Look at the old one for guidance)

Insert the leads carefully into the PCB and snap the pillars into place through the PCB.

Level the display and solder 2 leads.

Inspect to be sure that it is level, then solder and crop remaining leads.

12.3.6 Rotary Switch Wafer Replacement

Remove 2 screws and nuts retaining the switch to the PCB.

Pull off the switch mechanism. Be sure to retain the 2 fibreglass washers between the switch wafer and PCB, and the metal spacers.

Clip off the switch wafer leads.

Desolder leads and clean holes.

Correct orientation of the switch wafer and mechanism is vital to correct functioning of the front panel system. Take careful note of the instructions and diagrams.

The mechanism and wafer are normally supplied in the fully anticlockwise position. Check that this is so. Then, when the wafer is placed on the shaft in the correct way, the moving contact should be making contact with a fixed contact at one end; NOT near the middle.

Place the new wafer onto the PCB, orienting it as shown in Figure 12.3.2. DO NOT SOLDER YET.

Reassemble the switch mechanism ensuring that:-

- 2 Fibre Washers go between the wafer and PCB
- 1 Fibre Washer at the rear

1 Lock Washer

Screw tightly to the PCB.

Examine to confirm washers are still on place and that the switch is properly aligned with the PCB.

Resolder.

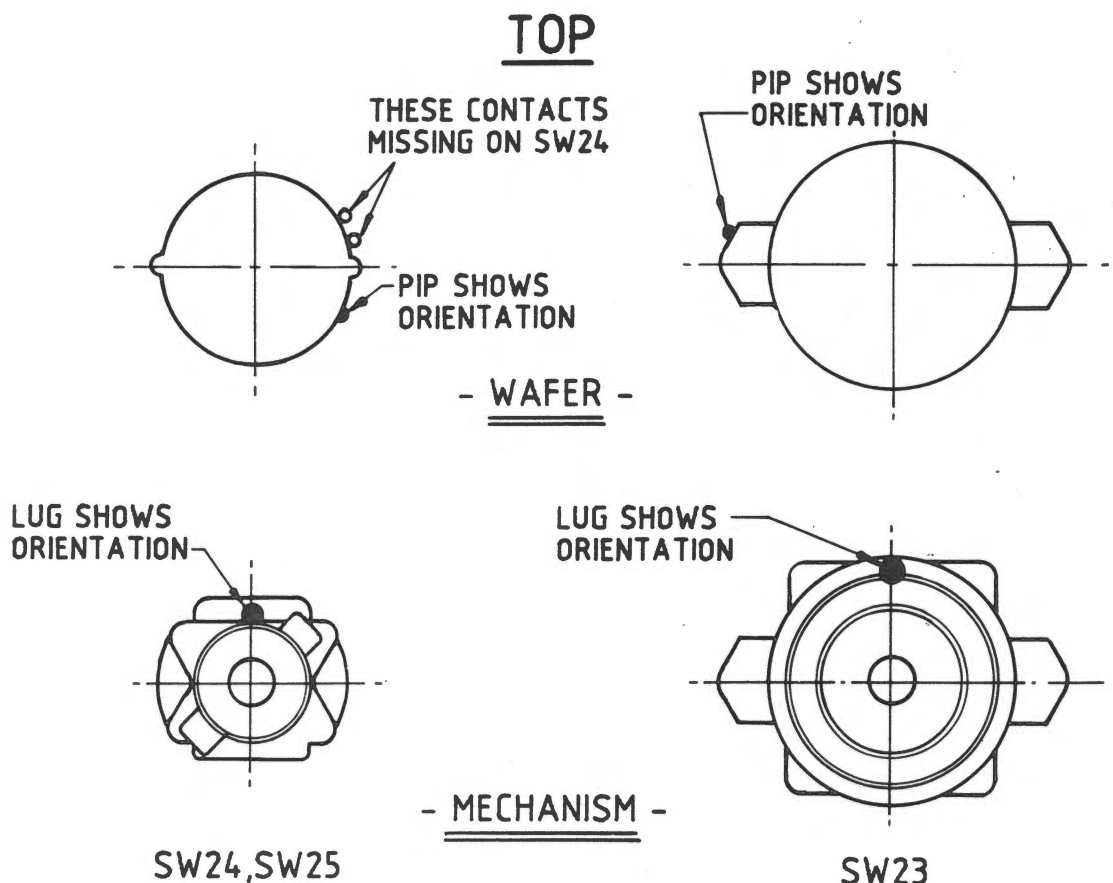


Figure 12.3.2 Orientation of Rotary Switches

12.3.7 Meter Movement Replacement

Remove front panel assembly from test set.

Carefully bend 4 tabs back holding meter body into bezel on rear of meter movement.

Extract meter to rear of front panel assembly.

Replace in the opposite manner.

Then recalibrate meter driver as described in Meter Driver Section 9.

12.3.8 Refitting of PCBs

Locate the switches and LEDs of PCB75015 into the front panel.

Put on the 11 fibre washers. Apply low strength thread locking compound (e.g. Bostik T22) to the end of the 11 studs. Put on the nuts. Tighten fingertight only.

Check alignment and switch clearance. Adjust as required.
Tighten the nuts.
Locate the three rotary switches and two LEDs into the front panel.
Replace three 13mm nuts onto rotary switch bushes and tighten.
Replace two M3 screws into top of PCB and tighten.
Rotate the 3 switches fully anti-clockwise.
Replace knobs and align with most anti-clockwise mark on the front panel.
Tighten the collet nuts.
Replace yellow knob caps.

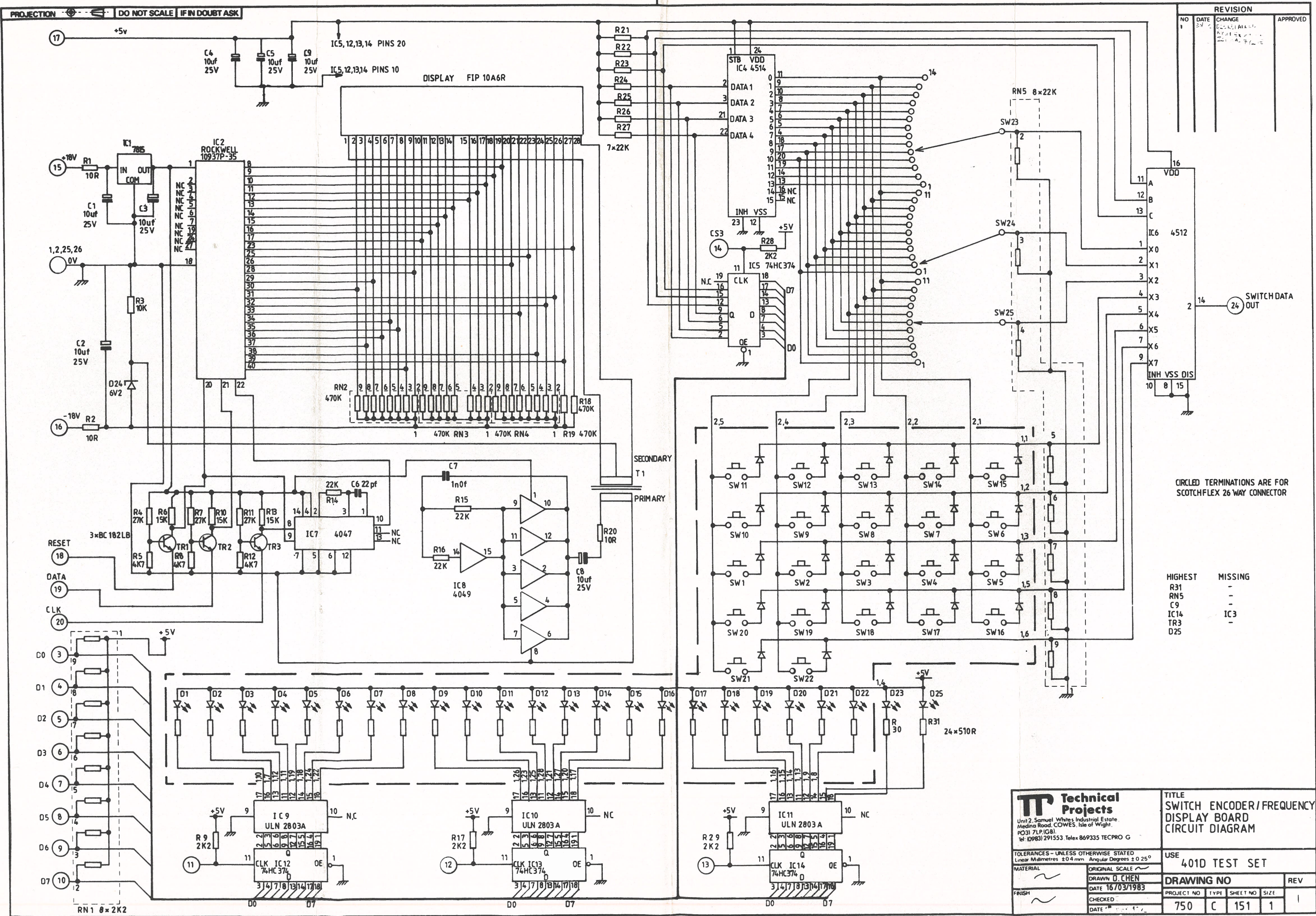
12.3.9 Reinstallation of Front Panel

Plug meter cable assembly into Motherboard.
Plug ribbon cable into TOP connector on Microcomputer PCB (CONN 2).
Carefully insert the panel into the test set housing and replace 6 screws.

12.4 Calibration

If the meter movement has been replaced, then re-calibrate the Meter Driver as described in Section 9.

No calibration is required for the Front Panel Assembly itself.



REVISION			
NO	DATE	CHANGE	APPROVED
1	16/03/1983	INITIALS	

CIRCLED TERMINATIONS ARE FOR SCOTCHFLEX 26 WAY CONNECTOR

HIGHEST	MISSING
R31	-
RN5	-
C9	-
IC14	IC3
TR3	-
D25	-

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TITLE
SWITCH ENCODER / FREQUENCY
DISPLAY BOARD
CIRCUIT DIAGRAM

TOLERANCES - UNLESS OTHERWISE STATED
Linear Millimetres ±0.4mm Angular Degrees ±0.25°

USE
401D TEST SET

MATERIAL
~

ORIGINAL SCALE
DRAWN D. CHEN
DATE 16/03/1983

FRUSH
~

CHECKED
DATE

PROJECT NO
750

TYPE
C

SHEET NO
151

SIZE
1

REV
1