GEC

WB900 Subscriber Carrier Equipment

Installing a subscriber terminal unit

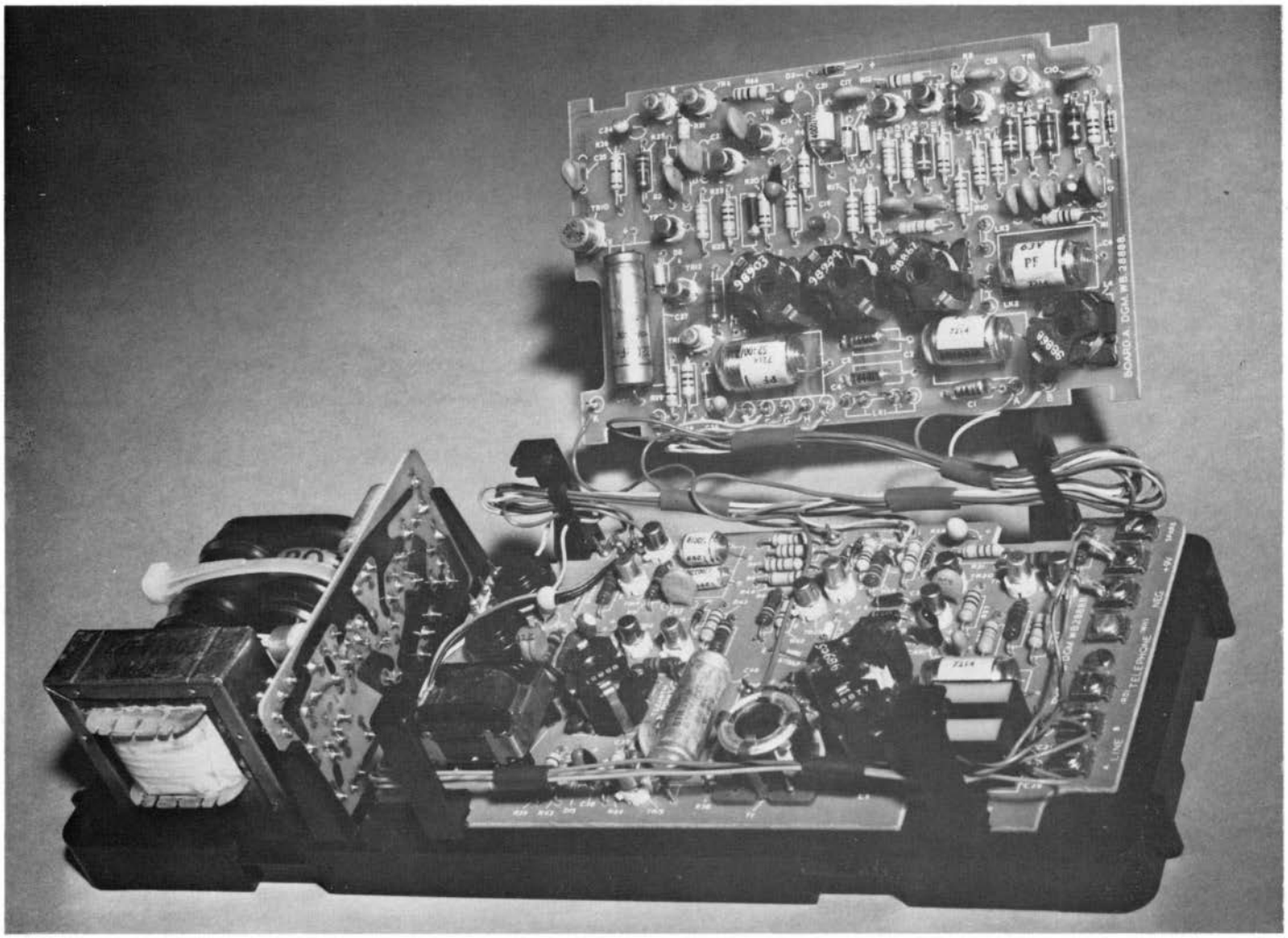
GEC Telecommunications Limited
A Management Company of The General Electric Company Limited of England

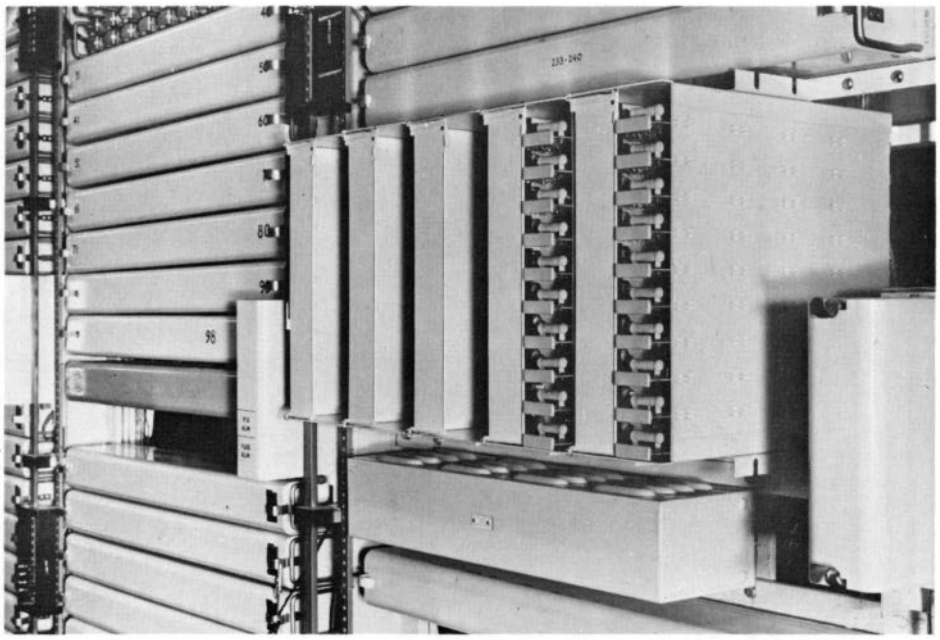
WB900 subscriber carrier equipment enables the capacity of a local exchange area multipair cable network to be almost doubled without adding extra cables or involving any expensive civil engineering works.

The additional capacity is achieved by adding a telephone circuit electronically to each unloaded cable pair when required. An extra (carrier) circuit shares a cable pair with an existing (physical) circuit but, unlike shared-service, the two circuits are completely independent: neither is aware of the presence of the other. The extra subscriber has all the facilities offered by a two-wire exclusive subscriber line.

WB900 will operate over all commonly used types of unloaded local area cables, and its range is similar to that of the normal physical circuit. WB900 modulates the speech signals on to carrier frequencies above the speech band. The physical circuit signals are transmitted at the normal frequencies.

WB900 Subscriber Carrier Equipment





Typical exchange terminal installation. The hinged retaining panel is shown open to allow the printed-circuit cards to be withdrawn: the inside of the panel is used to identify the individual circuits.

A complete system comprises:

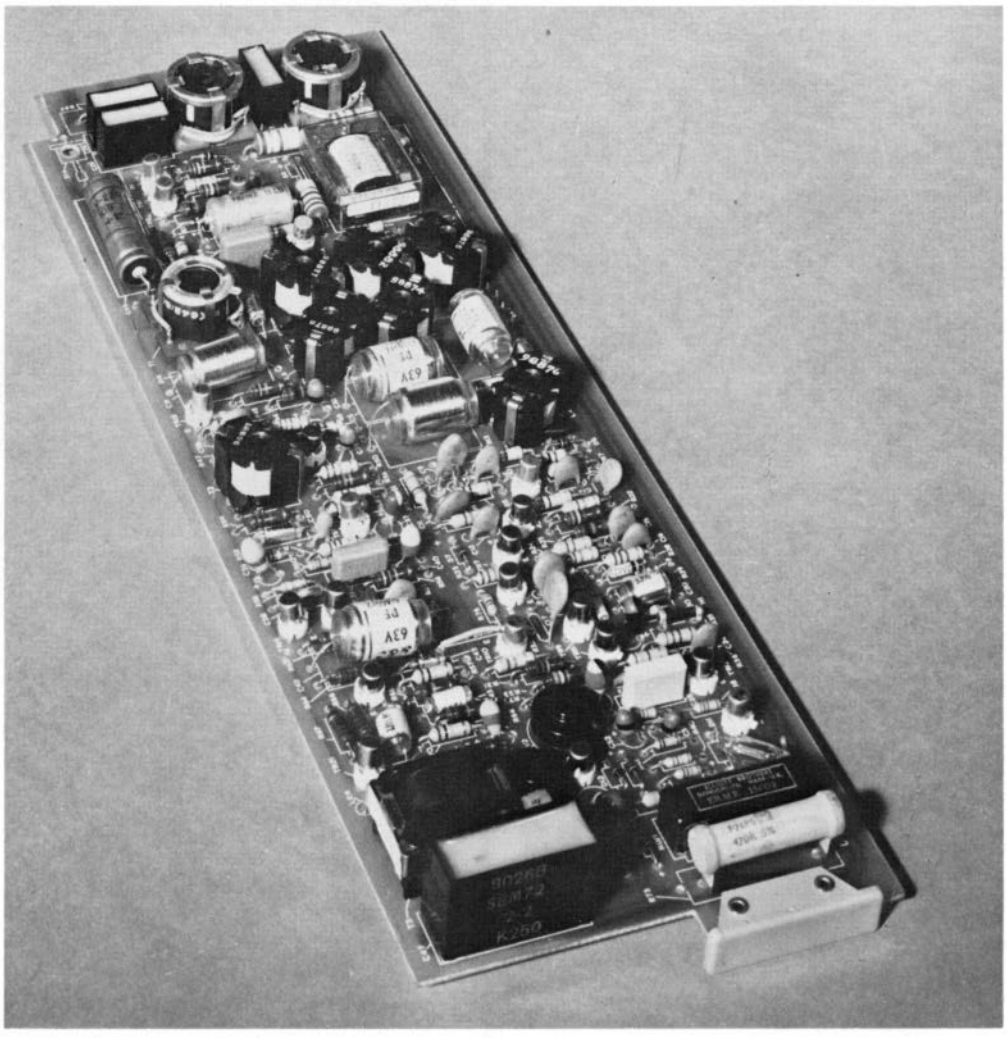
- Subscriber terminal D98860
- Rechargeable battery D98884
- Physical-circuit isolating filter D98870
- Exchange terminal D98873
- Exchange terminal housing D99080, to house up to 10 terminals, complete with DC power regulator

The **exchange terminal,** including a physical-circuit isolating filter, is mounted on a single printed-circuit board, with an integral edge connector.

The exchange terminal **housing** will contain up to 10 terminal units and the power-supply regulator to operate up to 10 terminals. A number of housings can be mounted side-by-side to form a rack shelf, or a single housing can be wall mounted.

The **subscriber terminal** circuit elements are mounted on three

Subscriber terminal with cover removed and circuit boards displayed



Exchange terminal printed-circuit card

small printed-circuit cards contained in a plastic case suitable for wall mounting.

The **physical-circuit filter** associated with the physical-circuit telephone is encapsulated and has a 4-wire 'cable tail' and is suitable for interior or exterior mounting.

Power supply

A power supply is required at both terminals; at the exchange, this is derived from the exchange battery via a regulator mounted on the terminal housing. Power for both the subscriber terminal and the telephone-transmitter feed are provided by a rechargeable nickel-cadmium battery within the unit and does not normally require access to an AC supply at the subscriber's premises. The battery is charged over the line from the exchange battery when both the carrier and physical circuits are idle (when the physical circuit is in use, the charging circuit is automatically switched off).

The maximum on-hook current drain over the line is limited. The idle-circuit current is 4mA, and the remainder is available for charging the subscriber-terminal battery; the actual current depends on the state of charge of the battery. When the system is in use, 80mA is required during ringing bursts, and 50mA for talking.

The number of calls per day that can be made will be determined by the state of the battery which depends on

- the number and length of calls
- whether the calls are incoming (which involves ringing current) or outgoing
- how many abortive incoming calls have been made
- how many calls have been made over the physical circuit

The battery capacity and charging rate have been chosen to be more than adequate to satisfy the calling rate of the average domestic subscriber. An alternative mains-operated power unit is available for use with a subscriber terminal and can be used in place of the battery and charging unit. When this unit is used, the calling-rate limitation is removed.

Testing

The system can be tested from the exchange test desk without the need for additional or specialized test equipment. Special precautions are taken to ensure that the battery charging current does not interfere with normal line testing. For all tests, except line leakage, a WB900 equipped line appears to the test desk as a normal exclusive line and can be tested as such.

By arranging for an automatic one-minute delay between a 'clear-down' and re-instatement of battery charging, the true line leakage can be measured without the masking effect of the charging current.

Installation

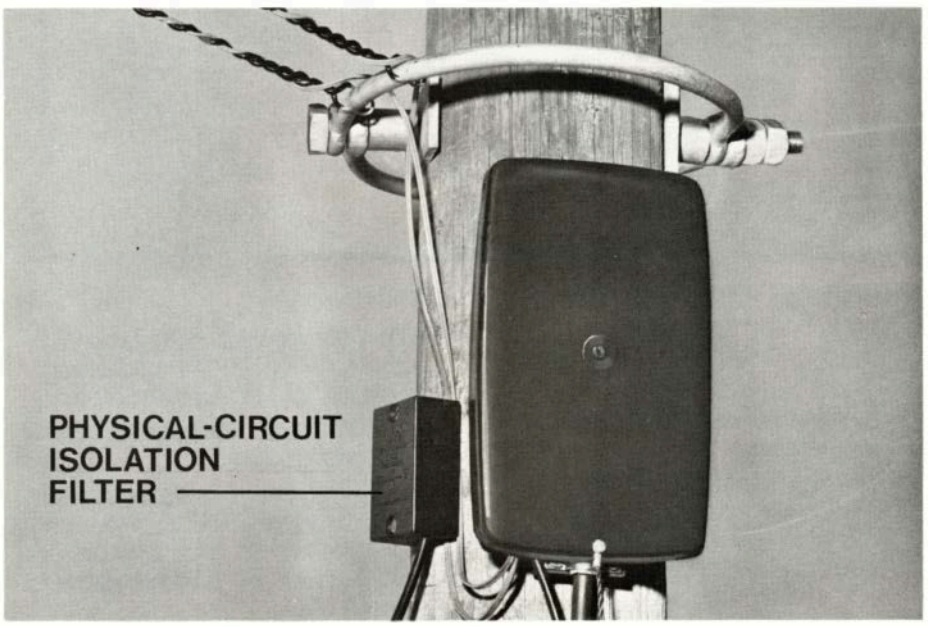
No special transmission skills are needed to install a WB900 system. The exchange terminal is rack- or wall-mounted; the subscriber terminal is wall mounted, secured by two screws, in any convenient unobtrusive position in the subscriber's premises: four wires have to be connected (two for the line and two for the telephone) to a screw-terminal field within the unit.

An AGC makes the system self aligning and self adjusting for varying line conditions so that no setting up is necessary. The system is insensitive to line reversal so that line polarity can be ignored.

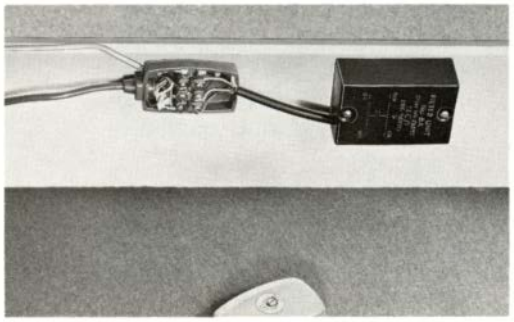
The only installation work required to the physical circuit is the addition of the physical-circuit filter between the line and the telephone. This can be either adjacent to the telephone terminal box or at the local distribution pole, as convenient.

Maintenance

Maintenance is minimal. Any on-site maintenance is limited to replacement of complete faulty units which would be repaired subsequently at a central repair depot.



Pole mounted location for the physical-circuit isolation filter



Alternative filter location, adjacent the terminal telephone connexion box

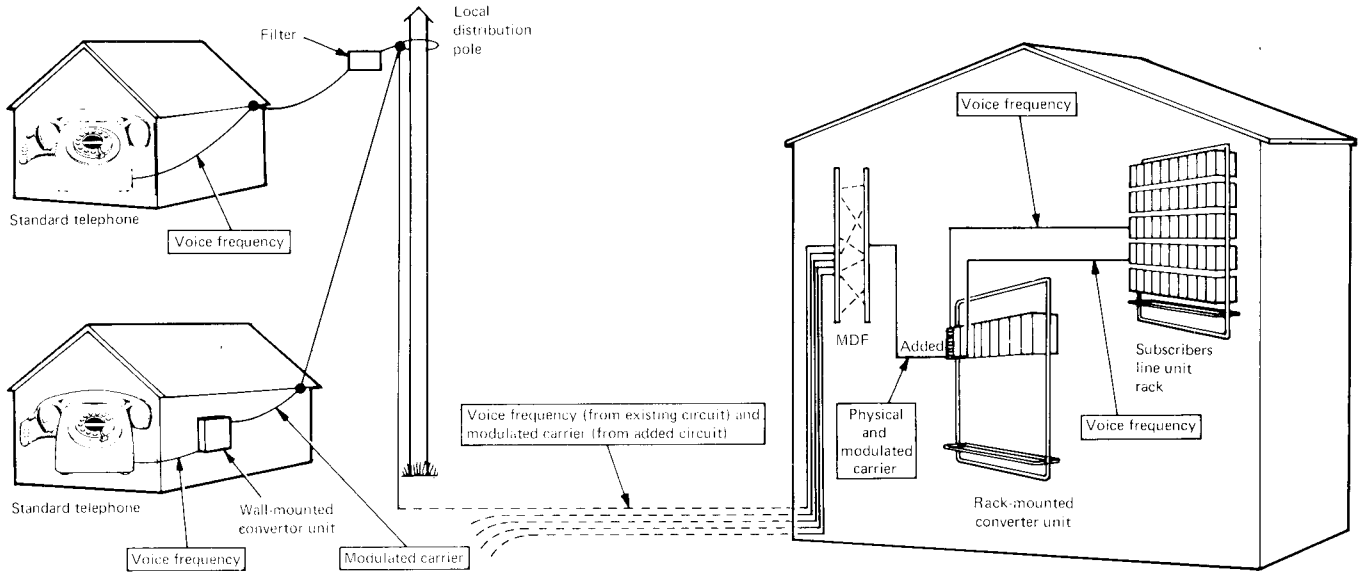
The added (carrier) circuit is provided by interposing an all-transistorised convertor unit between the added telephone and the nearest available physical-circuit cable, as illustrated in the diagram below: a corresponding unit is interposed between the line and the switching equipment at the exchange. A low-pass filter is fitted at both ends of the cable pair to isolate the physical circuit from the carrier circuit.

The carrier frequencies (40 and 64 kHz) are chosen for optimum cable crosstalk performance over a wide range of line conditions. Automatic carrier level regulation is included to minimize crosstalk; it compensates for line length, re-routing, and variations due to temperature. The choice of frequencies and the use of level regulation ensure that intelligible crosstalk is better than 60 dB for about 90% of cable pairs, thus rendering cable pair selection virtually unnecessary. Crosstalk is minimized by the fact that the carrier is only transmitted when the circuit is in use.

Both the physical and the carrier circuit use the standard range of telephones: there is no need to stock special instruments.

When new demands for service arise, WB900 subscriber carrier equipment is added at both ends of the nearest available cable pair: revenue-earning service is provided almost immediately with independent circuits for both the existing and the new subscriber.

Simplified diagram of a GEC WB900 system



Advantages

A large number of benefits accrue from the use of the WB900 concept to provide service at short notice almost anywhere in a local exchange network.

- It is not necessary to provide excess cable pairs when planning a local distribution scheme.
- Network capacity can be expanded to meet demands immediately by drawing systems from stock and connecting them to existing cables.
- A decision to install extra cables can be deferred until a growth pattern is clearly established.
- Where additional cables are subsequently installed, WB900 systems can be recovered for use elsewhere.
- The traffic capacity of a local multipair cable can be increased by up to 90%.
- Exclusive service can be provided where hitherto only a non-exclusive shared service is available.
- WB900 systems can provide temporary additional telephone circuits over existing lines for sporting events and similar short-term occasions.
- The use of WB900 does not in any way restrict the normal facilities available to the existing physical-circuit subscriber.
- WB900 can be added to a cable pair which is already providing shared service, to give two non-exclusive and one exclusive circuit per pair.
- WB900 will operate with rotary-dial or pushbutton telephones, as well as data modem equipment operating over ordinary telephone lines.

Constraints

When considering specific applications for WB900, the following points should be remembered.

- WB900 will not operate over loaded cables.
- The maximum cable loss must not exceed 40 dB at 64 kHz – equivalent to just over 6km (3.7 mile) of 0.5mm (6½lb/mile) cable.
- WB900 should not be used on routes which include more than two spans of open-wire line.
- WB900 is an AC-coupled system and is not suitable for applications where polarity reversal or ground signalling is used.

Data Summary

SYSTEM PERFORMANCE

Audio	Termination	Two-wire.	
	Impedance	900 ohms nominal*.	
	Frequency response	+1 to −3.5 dB, relative to 1 kHz, over the band 300 to 3400 Hz.	
	Insertion loss	Subscriber-to-exchange direction	Between 0 and 4 dB*.
		Exchange-to-subscriber direction	Between 2 and 6 dB*.
	Median talker level	At the exchange terminal	−16 dBm.
		At the subscriber terminal	−12 dBm.
	Overload margin	15 dB above median talker levels.	
	Total harmonic distortion	Less than 3% at median talker level; less than 11% at 13 dB above median talker level.	
	Idle channel noise	Less than −25 dBrnc, measured using an artificial line.	
	Balance return loss	Greater than 10 dB against 600 ohm termination, over the band 300 to 3400 Hz.	
Carrier	Termination	Two wire.	
	Impedance	140 ohms balanced (nominal).	
	Modulation	Amplitude, double sideband.	
	Carrier frequencies	Subscriber-to-exchange direction	40 kHz.
		Exchange-to-subscriber direction	64 kHz.
	Carrier frequency stability	±0.5%.	
	Transmission level	Subscriber-to-exchange direction	Automatically adjusted to give −35 dBm +5 dB at the exchange terminal.
		Exchange-to-subscriber direction	Between −5 and 0 dBm.
	Maximum line loss	40 dB at 64 kHz, including losses due to bridged pairs.	
	Signalling	System idle	No carrier transmitted.
		Ringing	64 kHz, modulated by ringing supply voltage.
		Off-hook	40 kHz transmitted.
		Loop-disconnect signalling	40 kHz interrupted carrier.
		MF signalling	40 kHz modulated by MF tones.
	Carrier leak at the audio two-wire point	Subscriber terminal	Better than −60 dBm per frequency.
		Exchange terminal	Better than −65 dBm per frequency.
Telephone	Transmitter current	Not less than 25 mA.	
	Local cable resistance	Not more than 25 ohms between subscriber terminal unit and the telephone instrument.	
	Ringing	Up to four telephone bells may be rung.	
Power supply	Exchange terminal	−12 V DC: derived from the exchange battery via a regulator.	
	Current	15 mA (idle) and 50 mA (in use), maximum.	
	Subscriber terminal	10 V DC 225 mAH rechargeable nickel-cadmium battery, charged from the exchange battery via the line (the charging circuit is automatically switched off when the physical circuit is in use).	
	Current	4 mA maximum (idle), 80 mA maximum (ringing), 50 mA maximum (talking).	
Protection		Will withstand 2 kV surges, 1 µs rise to full value and 50 µs fall to half value.	
Construction	Exchange terminal	Printed-circuit card incorporating withdrawal handle and edge connector housed in a 10-terminal assembly which can be wall or rack mounted.	
	Subscriber terminal	Printed-circuit cards contained in a clip-on case: wall mounted, retained by two screws.	
	Isolating filter	Encapsulated for interior or exterior mounting.	
Dimensions	Exchange terminal	100 × 290 × 38 mm over components (4 × 11⅜ × 1½ in approx.).	
	Exchange terminal mounting	295 × 105 × 300 mm (11⅝ × 4⅛ × 11⅞ in approx.).	
	Subscriber terminal	280 × 100 × 52 mm (11 × 4 × 2⅛ in approx.).	
	Isolating filter	50 × 30 × 80 mm (2 × 1¼ × 3⅛ in approx.) with integral 1 m (3 ft) cable tail.	
Ambient operating conditions		The equipment will operate within the quoted parameters over the temperature range −10°C to +50°C, and will maintain the specification figures after 21 days 'damp heat' as defined in British Standard BS2011, part 2C. The temperature range applicable to the physical-circuit isolating filter is −40°C to +50°C.	

PHYSICAL CIRCUIT PERFORMANCE — The operation of the physical circuit is not affected: the performance is varied only in the following respects.

Additional insertion loss	Less than 1 dB at frequencies up to 3.4 kHz due to the inclusion of the isolating filter. Higher frequencies will be attenuated.
Additional line-loop resistance	40 ohms maximum due to the inclusion of the isolating filters.

*Other impedances and levels can be supplied where required.

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