REMOTE CONTROL OF FIREMEN'S CALL-OUT SYSTEMS: SYSTEM DX

Control of Firemen's Call-Bells and Sirens at Ring-Out Points in Automatic Exchange Areas

1. Scope of Instruction. This Instruction describes the equipment used for Remote Control System DX, the facilities given, the renters' responsibilities, the installation of the system and the method of operation. General information on this and other remote control of firemen's call-out systems is given in B 3015. The terms used in this Instruction are in accordance with B 0003.

2. General. The system is intended, primarily, for the remote control of firemen's call-out bells and sirens at unattended fire stations served by automatic exchanges. System DX is a new and improved design based upon System D (see B 3023), but incorporating measures to overcome difficulties in service, particularly those associated with false operation, to which the earlier system was prone. The system requires A.C. mains supplies. Where similar facilities are needed for an unattended fire station served by a manual exchange, System G (see B 3030) will be provided.

3. Facilities. The facilities provided by System DX are as follows:-

(a) The operation of a system of firemen's call-bells and/or siren at a remote point via the public telephone network by means of a 1345/20 c/s. call-out signal.

(b) An identification signal of 370/100 c/s. is returned to the caller for 3 seconds as an indication that connexion to the required line has been effected.

(c) At any time up to 15 seconds from the receipt of the identification signal, the 1345/20 c/s. call-out signal may be sent to line. After this time, the remote equipment at the ring-out point will not accept a call-out signal.

(d) A lamp indication is given at the call-out point when the 1345/20 c/s. signal is sent to line.

(e) An acknowledgement signal of 370/100 c/s. is returned to the caller to indicate that the remote equipment is functioning, and is sent to line in synchronism with the operation of the call-bells.

(f) The siren operates continuously and the call-bells intermittently (3 seconds on and 3 seconds off) for the duration of the transmitted signal.

(g) The overall duration of the signals sounded at the remote station is controlled from the call-out point.

(h) The telephones associated with the equipments at call-out and ring-out points may be used for normal calls. For normal incoming calls, the telephone-bell at the ring-out point sounds for 15 seconds continuously. When a call-out signal is received, the telephone bell rings during the signal, and for a further 15 seconds unless it is cut off (by the key provided on the telephone) when the telephone is answered.

(j) Provision is made for a running-call facility at the ring-out point. The siren and call-bells function as for remote control.

(k) Where the siren is remote from the ring-out equipment, a remote-control private circuit may be used for controlling the siren.

(l) Under mains-failure conditions at the ring-out point, an incoming call (for remote call-out or conversational purposes) operates the call-bells and telephone bell in synchronism with the exchange ringing current and a running-call operates the call-bells continuously for the duration of the call. The siren will not, of course, operate when the mains supply has failed. The normal use of the telephone is unaffected by failure of the mains supply.

(m) The siren may be used for air-raid warning purposes to sound the "Alert" and "Raiders Passed" signals, as used during World War II, under the control of the call-out point. Information on the modifications necessary for this facility and for the provision of "Local Control" of the siren for a similar purpose will be published later.

4. Field of Use. System DX may be used wherever the ring-out point is served by an automatic exchange and where the necessary A.C. power supplies are available at the call-out and ring-out points. Normally, the call-out equipment is connected to an exchange line or P.B.X. extension at an attended fire station and the ring-out equipment to an exchange line at an unattended fire station. The call-out equipment may be used to remotely control any ring-out equipment where attenuation between stations does not exceed 24.5 db. at 1600 c/s. This should cover any normal connexion via the exchange network over which remote control is likely to be required.

5. Power Supplies.

(a) The call-out and ring-out equipments are designed to operate from 200/250V., 50 c/s., A.C. mains supplies and will function satisfactorily with variations of up to + 10% and - 20% of the nominal mains voltage.

(b) At the ring-out point, battery supplies are required to operate the call-bell groups (see B 3001). Additionally, one of these batteries is used to operate the telephone bell and the relay controlling the call-bells, and its voltage should not be less than 30V. The equipments are designed to be used with the mains supplies permanently switched on.

6. Renter's Responsibilities. In addition to providing suitable dry accommodation for the P.O. equipment at the points concerned, the renter will also be responsible for providing and maintaining the following:-

(a) At the call-out and ring-out points.

(i) A 5-amp., 3-pin switch socket to B.S. 546 (equivalent to a "Socket-outlet No. 8") on which should be terminated a suitable mains supply (see par. 5) and an efficient earth connexion.

(ii) Wooden battens in accordance with Drg. CD 912 for wall-mounting the equipments.

(b) At the ring-out point only. A suitable weatherproof housing for the "press-button S" when the running call facility is required.

(c) At the siren point.

(i) The siren and contactor, the associated wiring, and the power supply for the operation of the siren.

(ii) The wiring between the "Equipment, Control, FA 240" (or the P.O. relay switch when the siren is remote from the ring-out point) and the renter's apparatus. All such wiring should be kept well clear of P.O. wiring.

(iii) A suitable isolating switch or fuses which will enable the operation of the contactor to be checked during routine testing without operation of the siren.

(iv) An auxiliary switch or press-button for the local control of the siren.

(v) A time switch to disconnect the siren contactor and so prevent the operation of the siren during the night.

*7. Equipment.

(a) The call-out point equipment is rack-mounted and comprises a power panel, oscillator, and control panel. Associated with this equipment is a "Telephone No. 332 ....", (or "Telephone No. 396 LB" in local-battery areas), a "Press-button S" (which should be adjusted to remain operated for approximately 1 minute) and a signal-indicating lamp. The call-out equipment, together with all the associated apparatus, is shown schematically on Dgms. FA 275/0 and FA 275/1, for which diagram notes are available.

(b) The ring-out point equipment is rack-mounted and comprises a power panel, receiver panel, a relay-set and control panel. Associated with this equipment is a "Telephone No. 326 ....", the call-bell groups, the running-call "Press-button S" (to be adjusted to operate for 1 minute), the renter's apparatus and, when the siren is remote from the ring-out point, a "Frequency-changer No.5" (Dgm. SA 5011). The latter is used to provide a 100 c/s. supply from 50 c/s. mains to operate a "Relay Switch, No. 101 A/2 or 201 A/1" (Dgm. SA 9067) at the siren point. The ring-out point equipment, together with all the associated apparatus, is shown schematically in Dgms. FA 276/0 and FA 276/1, for which diagram notes are available.

*8. Details of Equipment.

(a) Call-out point. "Equipment, Control, FA 239" (21¼ in. wide by 24 in. high by 9 in. deep, weight 70 lb. approx.) comprises:-

(i) "Panel, Power, FA 268" which supplies power to operate the "Oscillator, No. 38A" and the signal-sending relay and indicating lamp from the mains supply. The plug and socket, interlocking with the cover of this panel, is provided to connect the mains supply and must be disconnected before the cover can be removed.

(ii) "Oscillator, No. 38A" which generates the 1345/20 c/s. signal which is transmitted to control the remote equipment. Jacks are provided for observing the cathode current in each of the three valves. The cover of this oscillator is fixed with patent fasteners, incapable of direct release by hand, as a protective measure. The Mark 2 "Oscillator No. 38A", which is interchangeable with the Mark 1 model, has a modified output circuit.

(iii) "Panel, Control, FA 270" which contains all terminals for P.O. connexions, the relay for switching the 1345/20 c/s. signal to line and a filter circuit associated with the telephone which limits the level of the 1345/20 c/s. signal in the receiver circuit to permit the ring-back tone to be heard satisfactorily.

(iv) "Rack, Apparatus, No. 54A" which is used for mounting the power panel, oscillator and control panels.

(b) Ring-out point. "Equipment, Control, FA 240" (21¼ in. wide by 36 in. high by 9 in. deep, weight 110 lb. approx.) comprises:-

(i) "Panel, Power, FA 273" which supplies power to operate the "Panel, Receiver, FA 272", the relays other than those used under mains-failure conditions,

the oscillator for answer-back and ring-back tone generation and the timing circuit which controls the call-bells. This panel contains the answer-back and ring-back tone oscillator which generates a 370/100 c/s. signal; it also contains the high-voltage relays necessary to operate the renter's siren contactor circuit and to switch the H.T. to the answer-back and ring-back tone oscillator. A jack is provided to observe the cathode current of the valve in the oscillator. A plug and socket, interlocking with the cover of this panel, is provided to connect the mains supply and must be disconnected before the cover can be removed.

(ii) "Panel, Receiver, FA 272". This panel contains the receiver which accepts the 1345/20 c/s. signal and discriminates against any other signals, thereby achieving immunity from false operation. A jack is provided to observe the cathode current of the valve in the receiver circuit. The Mark 2 "Panel, Receiver, FA 272" has a modified output circuit which gives improved protection against line current surges. The Mark 1 and Mark 2 models are interchangeable.

(iii) "Relay-set, FA 271" contains all relays used in the equipment other than the two high-voltage relays situated in the power panel.

(iv) "Panel, Control, FA 274" contains miscellaneous components associated with the relay-set, the timing-control circuits for the call-bells and the 15-second delay, together with the terminals for all P.O. connexions other than those for the mains connexion to the "Frequency-changer No. 5" when fitted. The connexions for this will be made to the "Panel, Power, FA 273". The Mark 2 "Panel, Control, FA 274" has minor wiring changes which simplify connexion of the telephone.

(v) "Rack, Apparatus, No. 54B" which is used for mounting the power panel, receiver panel, relay-set and the control panel.

***9. Diagrams.** Table 1 gives details of various diagrams relating to the equipment used in the remote control system.

*TABLE 1

Equipment	Diagram No.
Equipment, Control, FA 239	FA 239
Panel, Control, FA 270	FA 270
Oscillator No. 38A (Mark 1)	FA 269/0
" " " (Mark 2)	FA 269/1
Panel, Power, FA 268	FA 268
Equipment, Control, FA 240	FA 240
Relay-set, FA 271	FA 271
Panel, Power, FA 273	FA 273
Panel, Control, FA 274 (Mark 1)	FA 274/0
" " " " (Mark 2)	FA 274/1
Panel, Receiver, FA 272 (Mark 1)	FA 272/0
" " " " (Mark 2)	FA 272/1
Wooden fixing battens, for equipments	CD 912

NOTE:- Dgms. FA 275/0 and 275/1 and FA 276/0 and 276/1 show the whole system schematically.

10. Installation.

(a) Where the renter wishes to use more than one telephone for control purposes at the call-out point, a duplicate equipment and associated apparatus should be fitted.

(b) At the ring-out point, the remote-control equipment should normally be associated with an ex-directory exchange line used exclusively for remote control. If the provision of such a line cannot readily be arranged, due to line plant or other difficulties, no objection will be raised to the use of an existing exchange line as a temporary measure. There are obvious objections to the dual use of an exchange line for adminstrative as well as remote-control purposes, the most important being:-

(i) the risk that the line may be engaged when required for remote control

(ii) the fact that the telephone bell for an administrative call will only ring for 15 seconds.

(iii) Under mains-failure conditions, the call-bells operate in synchronism with the exchange ringing current for all incoming calls.

11. Mounting. The "Equipments, Control, FA 239, and FA 240", are suitable for wall mounting. They should be fixed with coach screws on wooden battens provided and fixed by the renter in accordance with Drg. CD 912.

(a) Call-out point. The "Press-button S", the signal-indicating lamp and its associated "Jack, Lamp, No. 25" should be mounted conveniently near the telephone used for remote-control calls.

(b) Ring-out point. All apparatus associated with the call-bells and the mains-failure alarm indicator (where fitted) should be mounted on a suitable wall-board, together with the "Frequency-changer No. 5" when required for a remote siren point.

(c) Siren point, remote from ring-out point. The "Relay, Switch, No. 101 A/2 or 201 A/1" should be mounted as rigidly as possible to obviate false operation due to mechanical shock. The frame of the switch should be connected to the mains protective earth.

12. Wiring. The wiring by the P.O. should be as follows:-

(a) Mains wiring should be "Cord, Flexible, E.L., 250V., Class D3, 0.0010 sq. in." and "Cable, E.L., 250 V., 0.0020 sq. in." where indicated on Dgm. FA 276, for connecting the "Frequency-changer No. 5".

(b) All other wiring should be "Cable, I.R.V. and C.B., 1 pr./12½, Brown or Cream", "Cable, I.R.V. and P.V.C., 1 pr./12½, Brown or Cream" or "Cable, E. and C.Core, 1 pr./10". This wiring should be well separated from all mains-voltage wiring.

13. Adjustments. Normally, adjustments to the equipment should not be required as the outputs of the oscillators and the trimming of the various tuned circuits etc. will be set during manufacture. For maintenance purposes it may be necessary to check the level of the signals sent to line and the following is an outline of the procedure to be adopted:-

(a) "Equipment, Control, FA 239". The level of the 1345 c/s. signal when not interrupted at 20 c/s. is + 12 db. relative to 1 mw. in 600 ohms, at the line terminals. Since the 1345 c/s. signal is interrupted (1/40 sec. on, 1/40 sec. off) the average level of the 1345/20 c/s. signal to line will be + 9 db. To check the level of the 1345 c/s.signal and the modulation of it by the 20 c/s. signal, two tests are required, during which the telephone handset should be removed from its rest. *(NOTE:-* When making the necessary connexions the mains should be switched off.)

(i) The line connexions to terminals S1 and S2 on the control panel should be disconnected and replaced by a "Decibelmeter No. 5" set for a terminated measurement (TRANS). Remove links LKA and LKB on the oscillator panel and connect a 24-V. battery to the sockets marked + and − . With the mains supply switched on and with the "Press-button S" operated, the meter should indicate approximately + 12 db. This level may be varied by means of the variable resistor RV1 on the oscillator panel.

(ii) With the above conditions, but with the battery removed and the links LKA and LKB replaced, the meter should indicate a level of approximately + 8 db.

(b) "Equipment, Control, FA 240". The level of the 370/100 c/s. identification and acknowledgement signal sent to line is normally adjusted to be about + 8 db. peak, relative to 1 mW. in 600 ohms. This may be reduced to + 1 db. if required by moving the lead on terminal A to terminal C and strapping terminals A and B of the oscillator attenuator which is mounted in the power panel. This rearrangement of connexions places the 7 db. attenuator R6, R7 and R9 in the output circuit.

14. Maintenance Testing of the Exchange Line at the Ring-out Point. Prior to any maintenance testing of the line, the renter must be advised so that the siren and call-bells may be made inoperative during the testing.

15. Maintenance of Control Equipments. The maintenance work on "Equipments, Control, FA 239 and FA 240" should normally be slight. If internal faults occur other than with the wiring, fuses, valves, relays or simple components, the panel concerned should be maintenance exchanged.

RELAYS. Relay adjustments for relays other than the three mentioned below should be carried out in accordance with TELEPHONES, Automatic, B 5144 (for 3000-types) or B 5173 (for high-speed types).

(a) Relay RA (assembled from 3000-type piece parts which may be requisitioned separately for maintenance purposes) should be adjusted as follows:-

(i) Armature travel 31 ± 1 mils

(ii) Armature residual 4 ± 1 mils

(iii) Contact clearance and pressure as for standard white label relays

(iv) Following saturation with a current of 15 mA., the bias spring should be adjusted to meet the following tests:-

Non-operate current 2.1 mA.

Operate current 2.6 mA.

Relays LR and SC. These relays are similar to the "Relay, High-Voltage, No. 3/8" and should be adjusted in accordance with TELEPHONES, Automatic, B 5180, except for that part of par. 4 referring to a special armature retaining screw and the adjustment data given in par. 5. Adjustment data for relays LR and SC are as follows:-

(i) Armature travel 31 ± 3 mils

(ii) Armature residual 12 ± 2 mils

(iii) Contact clearance 10 mils minimum

(iv) Spring thickness 14 mils

(v) Spring tensions:-

	Test	*Re-adjust*
Lever spring	4 to 9 gm.	5 to 8 gm.
Make and break springs	15 to 21 gm.	16 to 20 gm.

**VALVES.* The valve currents may be measured at the jacks provided, by means of a Plug No. 316 with a suitable cord and a voltmeter. The jacks are wired to 300-ohm resistors (in the valve cathode circuits) across which the potential may be measured and the valve current calculated. A voltmeter having a resistance of the order of at least 500 ohms per volt should be used; a "Meter, Multi-range, No. 3" (used on the 30-V. or 10-V. range) is satisfactory but a "Detector No. 2 or No. 4" is unsuitable owing to its low resistance. The table below shows the current values for various potentials across the 300-ohm resistors.

Voltmeter reading (volts)	1.2	1.5	1.8	2.1	2.7	3.3	3.9	4.5	5.1	6.0	6.9	9.0	10.5	12.0
Current (mA.)	4.0	5.0	6.0	7.0	9.0	11.0	13.0	15.0	17.0	20.0	23.0	30.0	35.0	40.0

In the quiescent condition the valve currents should be:-

(a) Equipment, Control, FA 239

(i) Oscillator No. 38A
20 c/s. oscillator valve V1
13 ± 2 mA. (Mark 1)
11 ± 2 mA. (Mark 2)

(ii) Oscillator No. 38A
1345 c/s. oscillator valve V3
5 ± 1 mA. (Marks 1 and 2)

(iii) Oscillator No. 38A
amplifier valve V2
9 ± 2 mA. (Mark 1)
20 ± 3 mA. (Mark 2)

(b) Equipment, Control, FA 240

(i) Panel, Receiver, FA 272
Receiver valve V1 11 ± 2 mA.

(ii) Panel, Power, FA 273
370/100 c/s. Oscillator valve V1 35 ± 5 mA.

Valve currents outside the stated limits indicate a fault condition.

When the 1345 c/s. oscillator valve (V3) has to be changed the output of the oscillator should be checked as described in par. 13*(a)*. If an indicated level of the 1345/20 c/s. signal of approximately + 8 db. cannot be obtained, the variable resistor RV1 should be adjusted to give the maximum output, and the strapping of resistors R 1-5 in the Inductor Unit L2 should be adjusted to give an indicated level of approximately + 9 db. The variable resistor RV1 should then be re-adjusted to give an indicated output level of + 8 db.

It is recommended that spare valves should be held as follows:-

(i) *For each installation comprising one or more "Equipments, Control, FA 239":-*

1 Valve, Electronic, CV 395
3 Valves, Electronic, CV 2136

(ii) *For each installation of an "Equipment, Control, FA 240":-*

1 Valve, Electronic, CV 395
2 Valves, Electronic, CV 431
1 Valve, Electronic, CV 2136
1 Valve, Electronics CV 1053
1 Valve, Electronic, CV 2213

***16. Operating Instructions.** Detailed instructions for the operation of the remote control system will be issued by the Fire Service to suit local circumstances. For the installation of a system, or for maintenance-testing purposes, the following procedures should be adopted, having previously acquired the authority and co-operation of the renter, to ensure that there is no false call-out of the Fire Brigade.

(a) Remote call-out (mains at the ring-out point normal).

(i) Set up a call from the telephone associated with the call-out equipment to the ex-directory exchange line at the ring-out point by requesting a "Routine Test Fire Call".

(ii) On receipt of the identification signal (370/100 c/s. of 3 seconds duration) which follows a short period of normal ringing tone, indicating that the required connexion has been established, the "Press- button S" should be depressed to its fullest extent and allowed to release automatically to send the call-out signal (1345/20 c/s.). The signal-indicating lamp should glow during the period that the press-button remains operated and the call-out tone will be heard at low level.

(iii) When the remote equipment is functioning satisfactory (i.e. the siren is sounding continuously and the call-bells sounding 3 seconds on, 3 seconds off, repeating), an acknowledgement signal (370/100 c/s. 3 seconds on, 3 seconds off, repeating), superimposed on the call-out tone, will be heard until the press-button releases, when all tones cease and the signal-indicating lamp darkens.

(iv) At the end of the call-out signal, and when the telephone at the ring-out point is answered, conversation will be possible. It is necessary to operate the press-button on the telephone to connect the telephone to the line.

(b) Remote call-out (mains failed at the ring-out points). When the call is set-up to the ring-out point, normal ringing tone will be heard, which will not be replaced by the identification signal. Under this condition, the call-bells and the telephone bell at the ring-out point will be operating in synchronism with the exchange ringing current.

(c) Running-call (mains normal). The running-call "Press-button S" at the ring-out point should be depressed to its fullest extent and allowed to release automatically. During its operated period, the siren will sound continuously and the call-bells will ring intermittently, 3 seconds on, 3 seconds off.

(d) Running-call (mains failed). Operation of the running-call press-button will cause the call-bells to ring continuously during the operated period.

17. Functional Testing of the System Functional testing of the system will be the responsibility of the renter, who will decide the nature and frequency of the tests and arrange tests accordingly. It is expected that there will normally be a daily test of the call-bell system and a weekly test of the siren and running-call press-button, together with a test of the facilities under mains-failure conditions. A key is provided for disconnecting the call-bells, as necessary, during testing and, with the key operated, only the station call-bell will ring when a test call-out is made. A switch for disconnecting the siren circuit is also provided, either by the renter or the P.O., according to whether the siren is local or remote.

References:- B 0003, B 3001, B 3015, B 3023, B 3030
(S) TELEPHONES, Automatic, B 5144, B 5180, B 5173

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