Remote Control System 8570/8571

Technical Service Manual

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1 About this manual

This Technical Service Manual provides technical descriptions, functional details and drawings for the 8570/8571 Remote Control System.

This manual assumes that you have a good understanding of electronics and a technical background.

This manual has nine chapters:

1 About this manual—lists all acronyms, abbreviations and units used in this manual

2 Overview and Specifications—general description of the remote control system and the specifications

3 Brief description—brief technical description of the remote control system including a general description of the major circuit functions

4 Technical description—8570—a more detailed technical description of the operation and circuit function of the remote control console

5 Technical description—8571—a more detailed technical description of the operation and circuit function of the remote control interface

6 Maintenance—details of maintenance, general cautions and warnings associated with the remote control system

7 Adjustments—describes the adjustments, checks and alignments for the remote control system and provides a list of the required test equipment

8 Parts List

9 Drawings

An index can be found at the end of this manual.

Standards and icons

The following standards and icons are used in this manual:

This typeface	Means
Italics	a cross–reference or text requiring emphasis

This icon	Means
	a warning—your actions may cause harm to yourself or the equipment
	a caution—proceed with caution as your actions may lead to loss of data, privacy or signal quality
	a note—the text provided next to this icon may be of interest to you
❑	a step to follow

Definitions

Acronyms and abbreviations

Acronym	Means...
A/D	analog to digital
AC	alternating current
ADC	analog to digital converter
ACIA	asynchronous communication interface adaptor
ADJ	adjust
AF	audio frequency
AFC	automatic frequency control
AGC	automatic gain control
ALC	automatic level control
ALF	absorption limited frequency
AM	amplitude modulation
ARQ	automatic repeat request
ASCII	American standard code for information interchange
ASSY	assembly
ATU	antenna tuning unit
AUX	auxiliary
AVG	average
BAL	balance
BALUN	balanced to unbalanced (transformer)
BCD	binary–coded decimal
BPF	band–pass filter
BW	bandwidth
C/O	changeover
CAL	calibrate
CCT	circuit
CCW	counterclockwise
CHNL	channel
CMOS	complementary metal oxide semiconductor
COAX	coaxial
COM	common
CPU	central processing unit
CRO	cathode ray oscilloscope
CRT	cathode ray tube
CSK	countersink

Acronym	Means...
CTS	clear to send
CW	continuous wave, carrier wave, clockwise
D/A	digital to analog
DAC	digital to analog converter
DC	direct current
DEMUX	demultiplexer
DMA	direct memory access
DPDT	double pole, double throw
DPST	double pole, single throw
DRG	drawing
DSB	double sideband
DSR	data set ready
DTL	diode transistor logic
DTR	data terminal ready
DVM	digital voltmeter
dB	decibel
dBm	decibel relative to 1 mW
EEPROM/ E^2PROM	electrically erasable/programmable read–only memory
ECL	emitter–coupled logic
EDP	electronic data processing
EMF	electromotive force
EMI	electromagnetic interference
ENRAM	enable RAM
EPROM	erasable programmable read–only memory
EXT	external
F/V	frequency to voltage
FEC	forward error correction
FET	field–effect transistor
FM	frequency modulation
FREQ	frequency
FSK	frequency shift keying
FTTL	fast transistor–transistor logic
GND	ground
GPIB	general purpose interface bus
HCMOS	high–speed complementary metal oxide semiconductor
HEX	hexadecimal, hexagon
HF	high frequency (3 MHz…30 MHz)
HMOS	high–speed metal oxide semiconductor

Acronym	Means...
HORIZ	horizontal
HPF	high–pass filter
I/COM	intercom
I/F	interface
I/O	input output
I/P	input
IF	intermediate frequency
IMD	intermodulation distortion
INT	internal
ISB	independent sideband
JFET	junction field–effect transistor
J3E	single sideband suppressed carrier telephony emission
LC	inductance–capacitance
LCD	liquid crystal display
LDR	light dependent resistor
LED	light emitting diode
LF	low frequency (30 Hz...300 kHz)
LIN	linear law
LO	local oscillator
LOG	logarithmic law
LPF	low–pass filter
LS	loudspeaker low–power Schottky
LSB	lower sideband, least significant bit
LSI	large–scale integration
LSTTL	low–power Schottky transistor–transistor logic
LTU	line terminating unit
MAX	maximum
MF	medium frequency (300 kHz...3 MHz)
MIN	minimum
MODEM	modulator–demodulator
MOL	maximum operating level
MOS	metal–oxide semiconductor
MPU	microprocessor
MSB	most significant bit
MSI	medium scale integration
MUF	maximum useable frequency
MUX	multiplex, Multiplexer
N/C	normally closed

Acronym	Means...
N/O	normally open
NC	not connected
NMOS	N–type metal oxide semiconductor
NOL	normal operating level
NOM	nominal
NORM	normal
npo	zero temperature coefficient
NTC	negative temperature coefficient
O/C	open circuit
OMT	orthomode transducer
O/P	output
OPR	operator
OPT	option
OSC	oscillator
OWF	optimum working frequency
PA	power amplifier
PCB	printed circuit board
PCM	pulse–code modulation
PD	potential difference
PEP	peak envelope power
PH	phase
PIA	peripheral interface adaptor
PIUT	paper insulated unit twin
PIV	peak inverse voltage
PKG	package
PLL	phase locked loop
PMOS	P–type metal oxide semiconductor
POL	peak operating level
POT	potentiometer
P–P	peak–to–peak
ppm	parts per million
PROM	programmable read–only memory
PSU	power supply unit
PTC	positive temperature coefficient (resistor)
PTT	press–to–talk
PUT	programmable unijunction transistor
PWM	pulse–width modulation
RAM	random access memory

Acronym	Means...
R/C	remote control
RC	resistance–capacitance
RCU	remote control unit
RD	read
REF	reference
REG	regulated; register
RF	radio frequency
RFI	radio frequency interference
RMS	root mean square
ROL	reference operating level
ROM	read–only memory
RTL	resistor–transistor logic
RTS	request to send
RTTY	radio teletype
Rx	receive, receiver
RXD	receive data
Rcvr	receiver
S/C	short circuit
S/N	signal–to–noise
(S+N)/N	(signal–plus–noise)–to–(noise) ratio
SCF	suppressed carrier frequency
SCR	silicon controlled rectifier
SINAD	(signal + noise + distortion)–to–(noise + distortion) ratio
SMPS	switching–mode power supply
SOT	select on test
SPDT	single pole, double throw
SPST	single pole, single throw
SSB	single sideband
STTL	schottky transistor–transistor logic
SWR	standing wave ratio
SYNC	synchronisation
SYNTH	synthesiser
T/R	transmit/receive
TC	temperature coefficient
Tcvr	transceiver
TCW	tinned copper wire
TCXO	temperature compensated crystal oscillator
TVRO	television receive–only

Acronym	Means...
TDM	time division multiplex
THD	total harmonic distortion
TRIG	trigger
TS	tag strip
TSM	technical service manual
TTL	transistor–transistor logic
TYP	typical
Tx	transmit, transmitter
TXD	transmit data
UART	universal asynchronous receiver transmitter
UJT	unijunction transistor
USART	universal synchronous/asynchronous receiver transmitter
USB	upper sideband
UT	universal time
UTC	universal coordinated time
V/F	voltage–to–frequency
VA	volt–ampere
VCO	voltage controlled oscillator
VCXO	voltage controlled crystal oscillator
VDR	voltage dependent resistor
VERT	vertical
VF	voice frequency, video frequency, variable frequency
VFO	variable frequency oscillator
VHF	very high frequency
VOX	voice operated switch
VSWR	voltage standing wave ratio
VU	volume unit
WR	write
WRT	with respect to
WT	weight
XTN	extension
XTND	extend
λ	wavelength
+ve	positive
–ve	negative
ϕ	phase, diameter in mm

Circuit reference designations

Abbreviation	Designation
A	assembly
B	transducer, microphone, loudspeaker
C	capacitor
D	diode—small signal and power
E	heating device
F	protection device, fuse
G	generator, battery
H	signalling/indicating device, lamp, LED, buzzer
IC	integrated circuit, thick film hybrid
J	jack/socket
K	relay, key switch
L	inductor
M	indicating device, meter
P	plug
R	resistor
S	switch
T	transformer, common–mode choke
TP	test point
U	modem modulator
V	semiconductor (not including small signal and power diodes)
X	terminal
Z	quartz crystal, crystal filter, frequency network

Units

Measurement	Unit	Abbreviation
current	Ampere	A
capacitance	Farad	F
frequency	Hertz	Hz
impedance	Ohm	Ω
length	metre	m
noise temperature	Kelvin	K
time	hour	h
time	second	s
power	Watt	W
resistance	Ohm	Ω
voltage	Volt	V
weight	gram	g

Unit multiplier

Unit	Name	Multiplier
M	mega	10^{6}
k	kilo	10^{3}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
µ	micro	10^{-6}
n	nano	10^{-9}

About this issue

This is the fourth issue of the 8570/8571 Technical Service Manual. The manual has been reviewed and updated to bring it into line with current product build structures.

Associated documents

This manual is one of a series of publications related to the 8570/8571 Remote Control System. Other associated publications are:

- 8570 and 8571 Remote control operators handbook (Codan part number 15–04018)
- 8570 and 8571 Remote control installation handbook (Codan part number 15–04070)

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2 Overview and specifications

This chapter contains:

- a brief overview of the remote control system (2–2)
- specifications for the remote control system (2–10)

Overview

The 8570/8571 Remote Control System provides remote control of HF radio systems over land lines or VHF/UHF radio links.

The system comprises two units: at the local end, a desktop Remote Control Console Type 8570, and at the remote end a desktop or rack mounted Remote Control Interface Type 8571.

Both 8570 and 8571 are microprocessor controlled with full revertive commands. This enables access to all sophisticated transceiver functions including channel scanning and selective calling. A wide range of configurations are available including multiple control points and separate transmit and receive sites. Line loss and equalisation adjustments are automatic.

The 8570 Remote Control Console has a LCD display incorporated to show full system status, and all front panel controls are membrane switches for fingertip control. The unit is AC mains powered and has an optional internal battery stand–by facility. Connection to the leased line is via an internal AUSTEL certified Line Isolation Unit (LIU). A 4–wire version is available for connection to a VHF/UHF radio link. Up to three units may be connected in parallel, per line, for multiple control operations.

The 8571 Remote Control Interface is connected to the transceiver and is powered from the transceiver DC supply. Up to four 2–wire lines each using an internal AUSTEL certified LIU or alternative 4–wire links, can be accommodated for more complex system configurations.

Operating instructions

Refer to the latest issue of *8570 and 8571 Remote control operators handbook*.

Specifications

General specifications

Table 2–1: General specifications

Item	Specification
Line Loss	Each line in a system can be up to 35 km of 0.64 mm PIUT (0.64 mm copper conductor, Paper Insulated Unit Twin) Note: Telstra now offers private lines with guaranteed performance levels The remote control system will operate on standard grade lines. Lines and radio links must be duplex
Frequency Response	400 Hz – 2.5 kHz ±3 dB
Noise	Signal/Noise better than 45 dB (excludes line/radio link noise)
Signalling	1070/1270 Hz FSK (part Bell 103) 550 Baud Revertive by command echo and verification 300 Hz control tone used with signalling and for PTT
Controls	Channel ↑, Channel ↓, Volume ↑, Volume ↓, Clarifier ↑, Clarifier ↓, Tune, Mode–USB/LSB, Transceiver On/Off, Scan, Selcall mute, Audio mute, Intercom, Display, Power On/Off, 0–9 numeric keypad, Recall, Enter, Send, Delete, Review ↑, Review ↓, selcall functions, special functions
Display	Backlit LCD, 2 line x 16 character
Power	8570: AC mains 100/120/220/240 V ±10% Battery standby (option) nom 5 hours 8571: 11 to 16 V DC (12 V nom) 200 mA, or 22 to 32 V DC (24 V nom) 100 mA
Size	8570: 205 mm W x 260 mm D x 120 mm H 8571: 250 mm W x 320 mm D x 78 mm H
Weight	8570: 3.8 kg 8571: 2.5 kg
AUSTEL Permit No	A91/19/0129

Panel connectors for 8570 Console

The following tables show the pin connections, functions, and signal levels for the rear and side panel connectors.

Table 2–2: Microphone

Pin No.	Function	Signal Level
1	PTT Ground	0 V
2	PTT Active	Active Low
3	Microphone Ground	0 V
4	Microphone Input	Nom. 50 mV P–P 8 kΩ I/P Imp
5	Speaker Ground Return	Link pin 5 to pin 7 for front panel speaker operation
6	Speaker Audio Output	13 V P–P max.
7	Speaker Ground	0 V

Table 2–3: AC mains input

Pin No.	Function	Remarks
A	Active	
N	Neutral	see rear panel
E	Earth	

Table 2–4: Option 2W

Pin No.	Function	Signal Level
1	No connection	
2	Telephone line	nom. 700 m V P–P in Tx
3	No connection	
4	No connection	
5	Telephone line	nom. 700 m V P–P in Tx
6	No connection	

Table 2–5: Option 4W

Pin No.	Function	Remarks
1 & 2	Balanced Audio Input	Input impedance > 3 kΩ
3 & 4	Balanced Input Output	Output impedance 600 Ω
5	Frame	
6	Ground	0 V
7 & 8	PTT relay contacts	To key link transmitter

Table 2–6: External loudspeaker

Pin No.	Function	Signal Levels
Tip	Speaker Audio Output	13 V P–P max.
Sleeve	Ground	0 V

Table 2–7: Option PM—miscellaneous facilities (15–10376–000)

Pin No.	Function	Signal Levels
1	Ground	0 V
2	Receive Audio Output	Nom. 1 V P–P from 1 kΩ
3	Transmit Audio Input	Nom. 0.5 V P–P 22 Ω I/P Imp
4	Quiet Line	Not used
5	Alarm Audio Input	Nom. 1 V P–P 2 MΩ I/P Imp
6	PTT Input	Active Low
7	Scan	Not used
8	A Rail	Nominal 12 V DC
9	RxD	±10 V Logic approx
10	TxD	±10 V Logic approx

Table 2–8: Option selcall alarm

Pin No.	Function	Signal Levels
1	Not used	
2 & 3	N/O Relay contacts	1 Amp 50 V rating
4	Not used	

Table 2–9: Option R—special purpose I/O (15–10377–000)

Pin No.	Function	Signal Levels
1	Speaker Audio Output	13 V P–P max.
2	Remote PTT	Active Low
3	Rx Audio Output	Nom. 1 V P–P from 1 kΩ
4	Power On	Momentary low
5	Ext. I^2C Bus (data)	5 V logic
6	Ext. I^2C Bus (Data Line Enable)	5 V logic
7	Ext. I^2C Bus (Clock out)	5 V logic
8	Transmit Lamp	Not used
9	Ground	0 V
10	Ground	0 V
11	Transmit Audio Input	Nom. 0.5 V P–P 10 kΩ I/P Imp
12	Rx demod O/P pre–mute	Nom. 1 V P–P from 1 kΩ source
13	Audio I/P post mute	Nom. 1 V P–P 10 kΩ I/P Imp
14	Ext. I^2C Bus (Interrupt)	5 V logic
15	A Line	Nominal + 12 V DC

Table 2–10: Option RS—RS232 interface (15–10378–000)

Pin No.	Function	Signal Levels
1		
2	RxD	+ 10 V Logic approx.
3	TxD	+ 10 V Logic approx.
4		
5	Ground	0 V
6		
7	RTS	+ 10 V Logic approx.
8	CTS	+ 10 V Logic approx.
9		

Table 2–11: Option M—morse facility (15–10374–000)

Pin No.	Function	Signal Level
Tip	Morse	Active Low
Sleeve	Ground	0 V

Table 2–12: Option PH—headphone output (15–10375–000)

Pin No.	Function	Signal Level
Tip	Audio Output	1.25 mW into 8 Ω
Ring	Audio Output	1.25 mW into 8 Ω
Sleeve	Ground	0 V

Rear panel connectors for 8571 Interface

Table 2–13: Transceiver Interface

Pin No.	Function	Signal Levels
1		
2	Remote PTT	Active Low
3		
4	Power on	Momentary Low
5	Tcvr I^2C Bus Data	5 V Logic
6		
7	Tcvr I^2C Bus Clock	5 V Logic
8		
9		
10		
11		
12		
13		
14	Ground	0 V
15	Ground	0 V
16	Transmit Audio Output	Nom. 3 V P–P 10 kΩ balanced
17	Rx Audio I/P pre–mute	Nom. 1.2 V P–P 10 kΩ balanced
18	Rx Audio I/P post–mute	Nom. 1.2 V P–P 10 kΩ balanced
19	Tcvr I^2C Bus Interrupt	5 V Logic
20		
21		
22		
23		
24		
25		

Table 2–14: Option 2W (15–10372–001)

Pin No.	Function	Remarks
1	No connection	
2	Telephone Line	
3	No connection	
4	No connection	
5	Telephone Line	
6	No connection	

Table 2–15: Option 4W (15–10373–001)

Pin No.	Function	Remarks
1 & 2	Balanced Tx Audio Input	Input impedance > 3 kΩ
3 & 4	Balanced Rx Audio Output	Output impedance 600 Ω
5	Frame	
6	Ground	0 V
7 & 8	PTT relay contacts	To key link transmitter

Table 2–16: Option RS—RS232 port (15–10391–000)

Pin No.	Function	Remarks
1	Rx Audio Output	
2	Ground	0 V
3	Ground	0 V
4	RxD	±10 V Logic approx
5	RTS	±10 V Logic approx
6	TxD	±10 V Logic approx
7	CTS	±10 V Logic approx
8	Rx Audio Ground	0 V

Table 2–17: Option I/O General Purpose (15–10392–000)

Pin No.	Function	Remarks
1	Ground	0 V
3	Input 1	Active Low
10	Input 2	Active Low
2	Input 3	Active Low
9	Input 4	Active Low
7	Relay 1A	Common
8	Relay 1A	N/C
15	Relay 1A	N/C
13	Relay 1B	Common
14	Relay 1B	N/C
6	Relay 1B	N/C
5	Relay 2	N/O to 0 V (ground)
12	Relay 2	N/O to 0 V (ground)
4	Relay 3	N/O to 0 V (ground)
11	Relay 4	N/O to 0 V (ground)

Options and accessories

Options

The options available for the Type 8570 remote control console are given in Table 2–18.

Table 2–18: Options for Type 8570 remote control console

Code	Options
2W	Fit for 2–wire operation
4W	Fit for 4–wire operation
FS	Fit PTT foot switch socket
M	Fit morse facility
PH	Fit headphone jack
PM	Fit miscellaneous facilities interface
R	Fit extended/remote control interface
RS	Fit RS232 port facility
SB	Fit standby battery facility—5 hours nominal operation

The options available for the Type 8571 remote control interface are given in Table 2–19.

Table 2–19: Options for Type 8571 remote control interface

Code	Options
2W	Fit for 2–wire operation
4W	Fit for 4–wire operation
ML	Fit for 3 or 4–line/link capability
RS	Fit RS232 port facility

Accessories

The accessories available for the 8570/8571 Remote Control System are given in Table 2–20.

Table 2–20: Accessories for the 8570/8571 Remote Control System

Code	Options
121	Module clamps (2)—locks 8571 to 93xx/8528 series transceivers
122	Module clamps (3)—locks 8571, 8540 and transceiver together
164	Rack mounting frame (483 mm) for 8571
169	Rack mounting frame (483 mm) for Type 8570 Console—iridescent grey
602	Headphones complete with cable and connector
641	Desk microphone complete with cable and connector
649	Extension loudspeaker
652	Morse key complete with base, cable and connector
654	Telephone handset complete with mounting cradle, cable and connector
655	Foot operated PTT switch, complete with cable and connector
2038	Service manual for Type 8570/8571 series

Power supplies

Table 2–21: Power supplies for the 8570/8571 Remote Control System

Code	Options
508	Voltage regulator (24 to 12 V operation)
9113 & 9114	AC power supply, 13.8 V DC regulated

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3 Brief description

This chapter provides a brief description of the major components and the circuit functions of the remote control system. It briefly describes:

- receive path (3–3)
- transmit path (3–4)
- signalling and microprocessors (3–5)
- automatic equalisation (3–6)

For a detailed description of these functions, see Chapter 4, *Technical description—8570* and Chapter 5, *Technical description—8571*.

General information

The information in this chapter should be read in conjunction with the Block Diagram (part number 03–00708).

In the absence of the control tone (300 Hz), the system provides an audio path from the transceiver/receiver through the Remote Control Interface 8571, via the land line (2–wire) or VHF/UHF radio link (4–wire), to one or more 8570 Consoles.

Application of the control tone from any point, removes all audio from the system in preparation for data signalling. Data is used to communicate to and from all microprocessors within the 8570/8571 network and includes commands such as select transmit mode (PTT), channel change, channel programming, system status etc.

When sending data, the control tone is present for the duration of the signalling, and on completion of the data transmission, reverts to the receive mode. Data is transmitted in simplex mode at 550 baud rate using Frequency Shift Keying (FSK).

The control tone is notched out of all external audio paths. Up to three 8570 Consoles may be connected in parallel. The correct line termination is provided by a selected unit.

Receive audio path

In the receive mode the audio from the transceiver is applied to the 8571 unit via an interface cable. The audio passes through a 300 Hz notch filter IC3 & 4, removing any 300 Hz that may be present in the receive audio that could possibly corrupt the performance of the system. The signal output from the filter is connected to an amplifier/compressor IC7, whose gain is controlled to maintain a constant audio output level.

At the output of IC7, the audio is fed via the signalling modem IC6, to the line driver IC102 and is then connected to either a 2–wire private line via the hybrid and first isolating transformer, or to a second isolating transformer for the 4–wire system.

The receive audio from the 2–wire line or 4–wire link is connected to the 8570 Console. The signal is passed via an isolating transformer to the first amplifier IC4a and then to a DC gain controlled amplifier IC10a, followed by a DC controlled equaliser IC10b/IC6b and a 3 kHz LPF IC7d. At the output of the LPF, the audio path continues through a 300 Hz notch filter IC11 (to remove the 300 Hz control tone), a mute detector/gate, and then via a DC controlled volume control to a power amplifier to drive the loudspeaker.

Transmit audio path

In the transmit mode, speech received by the microphone, is connected to a mixer amplifier IC1d in the 8570 Console. At its output, the signal is passed to a microphone compressor IC2a (to maintain constant transmit audio) and then combined with the 300 Hz control tone (present during transmit mode) at the input of mixer IC1a. The mixed output of IC1a, is applied to the line driver IC3 followed by a line isolation unit, to the 2–wire or 4–wire line output.

At the other end of the 2 or 4–wire link, the received audio is applied to the 8571 Remote Control Interface, via the appropriate isolation transformer, to a hybrid and then to the first amplifier IC101. From the output of this amplifier, the 300 Hz control tone is fed via a 300 Hz band pass filter IC106 (to remove the transmit audio) to a threshold detector IC104a/IC107. The transmit audio, (also containing the control tone but notched out later), is applied to a DC gain controlled amplifier IC103a, then to a DC controlled equaliser IC103b/IC104b. From here it passes via a 3 kHz LPF IC105a, through a switch selected to a 300 Hz notch filter (used also in the receive mode), removing the 300 Hz control tone, and finally via an interface cable to the transceiver transmit audio path.

Signalling and microcontroller

In a simple system, the network is controlled by two microprocessors: one located in the 8570 Remote Control Console, and the second in the 8571 Remote Control Interface.

In the 8570, the microprocessor IC7, operates a conventional, 16–bit address, 8–bit data configuration. Eight bits of the 16–bit address are connected directly to the EPROM IC5 and RAM IC4. The remaining eight bits are shared with the 8–bit data, made possible by the address latch IC6, and are connected to the EPROM and RAM, to complete the 16–bit address. The 8–bit data information (using the same bus) is applied to clock generator IC3, and the Display and Keyboard via the I/O expander IC2.

The I^2C Bus line from the microprocessor is used to control the DC outputs from the DAC IC16 and the I/O ports IC18, IC19 and control many of the local functions and setup parameters. The E^2PROM connected to the I^2C Bus, stores the current data supplied to the DAC and I/O ports including the automatic equalisation settings.

Power On Reset IC9 ensures the microprocessor resets correctly when the 8570 equipment is switched on.

The microprocessor in the 8571 and its peripherals is almost identical to that used in the 8570 except it does not contain a display or the keyboard. It is also used to communicate to and from the microprocessor in the transceiver.

Both microprocessors communicate to each other by means of the signalling modems IC13 (8570) and IC6 (8571) using the same audio paths as the transmit and receive signals described earlier.

The signalling employed is Frequency Shift Keying (FSK) using tones of 1070 Hz and 1270 Hz. Signalling integrity is ensured by parity check and echoing of each command. Signalling time varies depending on the complexity of the information exchanged, but is typically 150–200 ms including acknowledgment.

Automatic equalisation

When the automatic line equalisation is initiated, the receive path is first checked. The 8571 sends, first a 300 Hz tone followed by a 2 kHz signal. These tones are received by the 8570 and the levels measured by the microprocessor. The 300 Hz tone is adjusted for the correct level by the DC controlled amplifier, and the 2 kHz signal is set by the DC controlled equalisation circuit. Because both controls interact, the cycle is repeated until balance is achieved.

When equalisation of the receive path is completed, the process is repeated for the transmit path i.e. two tones sent from the 8570 and levels set up by the microprocessor in the 8571.

4 Technical description—8570

This chapter contains a technical description of the 8570. It includes the:

- power supply (4–2)
- receive path (4–3)
- transmit path (4–6)
- signalling and microprocessor (4–8)
- equalising and levelling (4–13)
- options (4–15)

This chapter should be read in conjunction with Chapter 9, *Drawings*.

Power supply

The 8570 Console is powered from an AC 50/60 Hz supply and depending on the position of the voltage selector, can operate on voltages of 100 V, 120 V, 220 V, or 240 V ±10%.

Power on–off

The input mains supply is connected to the primary of transformer T2 as shown on the Audio Processor & PSU PCB (refer 04–02585), and the 11 V centred tapped secondary is connected to diodes D4 and D5 to form a full wave rectifier circuit. The rectified output is connected to capacitors C90 to C93 to provide the filter network for the 14.5 V DC supply.

The power on is a hardware function. With latching relay K2 on the Audio Processor & PSU PCB (refer 04–02585) in the off state, C89 is charged. When the on–off keypad is pressed, V2 is turned on by a low to ground provided by a path through R115, then via a connector P7 pin 6 to the Microprocessor & Display PCB (refer 04–02586) to D2, the keypad, and D1. Prior to switch on, the cathode of D1 is at 0 V, due to the discharged state of capacitor C56 on the 5 V regulator IC15 located on the Audio Processor & PSU PCB. This action results in transistor V2 on the Audio Processor & PSU conducting and energising the on coil of the latching relay K2. The relay contacts change over to the on position and apply the 14.5 V DC to power up the equipment. With contacts K2 changing, the charging current to C89 is removed.

The equipment is switched off by a software function. The pressing of the on–off keypad sends a command, via the I/O port IC2, to the microprocessor IC7 (refer 04–02586) to initiate switch off. The microprocessor, via the I^2C Bus line, changes the output of DAC IC16 pin 9, on the Audio Processor & PSU PCB (04–02585), from 0 V to approximately 10 V causing transistor V1 to conduct and the off coil of relay K2 to energise. This results in the contacts of K2 to open. This removes the 14.5 V supply from the equipment and returns the DC supply to transistor V2 circuit (required for power on function).

Regulators

On the Audio Processor & PSU PCB (refer 04–02585), the 14.5 V supply, referred to as A rail, is connected to two regulators. A 10 V regulator IC14 identified as B rail, and a 5 V regulator IC15 known as +5 V. These supplies, including A rail, power both the Audio Processor & PSU, and Microprocessor & Display PCB assemblies.

Receive audio path

2 or 4–wire interface and I/P amplifier

With the 2–wire interface, the receiver audio from the 8571, is fed by land line and terminated into a modular telephone connector fitted on the rear panel of the 8570, and is applied to the input of the 2–wire interface assembly (refer 04–02585).

The 2–wire interface consists of an isolating transformer, a fuse and an overvoltage protection device, assembled in a fully insulated box. It is Austel approved.

At the output of the 2–wire interface unit, the receiver audio is connected to the Audio Processor & PSU PCB via pins 1 and 2 of connector P8 to the balanced input of amplifier IC4a. The input resistors R21, R22 and feedback resistor R26, set the gain at X2. A 680 Ω terminating resistor (R20) is be selected by latching relay K1.

With the 4–wire link, the receiver audio from the 8571, is terminated to pins 1 & 2 of the 8–way connector located at the rear of the 8570, and is applied to the 4–wire interface assembly (refer 04–02585).

The 4–wire interface consists of two isolating transformers (providing separate Tx and Rx paths) and include RF filter capacitors. The output of the Rx interface unit is connected to the Audio Processor & PSU PCB (refer 04–02585) via P9 pins 7 & 8, to the balanced input of amplifier IC4a. Input resistors R23, R24 and feedback resistor R26 set the amplifier for unity gain.

Gain and equalisation stage

From the output of IC4a (04–02585), the receiver audio is passed to a DC gain controlled amplifier IC10a, whose gain is set by the microprocessor to compensate for the losses in the land line or radio link.

The gain control element in the amplifier (IC10a) consists of a variable resistive cell (referred to as delta G) whose resistance decreases as the DC current is raised to the control input pin 1. In this circuit, maximum gain is when the cell is at its highest resistance (pin 1 is at zero current). AC gain is set by the input resistor R67 and the total feedback resistance of R66 in series with the internal 20 kΩ resistor, resulting in a gain of approximately 14.5 dB (X5). As the resistive cell is connected in parallel to the feedback resistance, an increase in DC current at pin 1 of IC10a will result in a decrease of the amplifier gain. Minimum gain is limited by the internally fitted 20 kΩ in series with the cell, being about 3.5 dB (X1.5).

From the gain controlled amplifier IC10a, the audio is passed to the first of two DC current controlled equalisation amplifiers IC10b & IC6b. Both these amplifiers operate in a similar manner to amplifier IC10a, described above, but are designed to give a DC controlled treble boost. This is to compensate for any high frequency loss on the land line. As both equalisers are almost identical, only a description of the first unit is given, except where detailed.

In this configuration, the resistive cell is in series with a 20 kΩ resistor and a 1 nF capacitor C68, and the resulting series network is connected in parallel to the input resistor R64. Because the cell is in the input circuit, and not part of the feedback network as used for the amplifier circuit IC10a detailed previously, minimum gain is when the cell has a high resistance (DC current on pin 16 is zero). This has minimum effect on the AC gain of the amplifier, therefore the gain is set by feedback resistor R62 in conjunction with input resistor R64. At this point, the amplifier has a flat AC response; the first (IC10b) has unity gain, while the second (IC6b) attenuates the signal by 6 dB.

As the DC current on pin 16 of IC10b and IC6b is raised by the microprocessor controlled DAC IC16, the resistance of the cell reduces, however, due to the AC reactance of the 1 nF capacitors (C68 & C62), the gain change will be proportional to the rise in frequency. At maximum gain, when the DC current is at maximum on pin 16, there will be approximately 2 dB increase at 300 Hz, rising to about 17 dB at 2 kHz for the first amplifier (IC10b) and, because of different resistor values, about 11 dB for second amplifier (IC6b). The combination of the two amplifiers will have a overall minimum gain of –6 dB (X0.5), and a maximum gain at 2 kHz of about 28 dB (X25). At the maximum gain setting, the gain will continue to rise with frequency until, at about 10 kHz, it will commence to roll off due to the influence of feedback capacitors C63 and C57.

Because the equalisation amplifiers have a rising gain with frequency (except at minimum gain) it is necessary to connect the output to a low–pass 3 kHz filter, to remove any high frequency noise that may result from the high gain in the equalisation amplifiers. IC7d and its associated components form an active 3–pole low–pass filter of conventional design.

300 Hz notch filter

From IC7d (refer 04–02585) the audio is connected to a 2–section digital filter, consisting of IC11, IC12c, IC12b, and associated components to produce a 300 Hz notch filter. It has unity gain at frequencies above 300 Hz, but produces high attenuation (> –40 dB) at 300 Hz. This is to prevent the 300 Hz control tone from being heard in the loudspeaker.

IC11 is a dual active filter and is driven by a 30 kHz clock (pins 10 and 11) provided from the tone generator IC3 on the Microprocessor & Display PCB. The high–pass (pin 18) and the low–pass (pin 20) outputs of the first active filter are phase mixed at the input of amplifier IC12c, resulting in the required notch response. The output from IC12c is applied to the second active filter and again the high and low–pass filter outputs are phase mixed at the input of IC12b. The two notch filters are slightly offset to each other, to produce about a 25 Hz bandwidth rejection centred at 300 Hz.

Audio mute

The audio from the second notch filter IC12b (refer 04–02585) is applied to both the mute gate IC20 and, via C75, to the audio mute input IC12a and IC13b operating as a squaring amplifier. The squared signal charges C78 via D10 during the negative excursions and the charge is transferred to C79 by transistor V9 during the positive excursions. The resultant DC voltage on C79 is proportional to the frequency of the audio. IC13a and its associated components form a low–pass filter with a cut off frequency of approximately 10 Hz. The output from IC13a is a DC voltage varying at the syllabic rate of the received speech. IC13c and IC13d form a window comparator whose window width is adjusted by R92, setting the mute sensitivity. The divider formed by R94 and R95, together with C82, averages the output of IC13a and provides the reference voltage for the window comparator. If the output from IC13a rises above or below this reference by the amount set by R92, then the output of either IC13c or IC13d will go high.

The comparator outputs are diode ORed into C86 to provide a fast attack, slow release (3 seconds) mute control signal, and operate the mute gate IC20 via buffer amplifier IC12d. The microprocessor can override the mute control circuit to produce a forced unmute by grounding the input voltage at pin 13 of IC12d (normally 5 V), or a forced mute by applying a ground to control input of gate IC20.

Volume control and audio amplifier

The output from the mute gate IC20 is applied to inputs of two amplifiers IC1b and IC1c. Amplifier IC1b is a unity gain buffer amplifier and its output is part of the option R facility. The second amplifier IC1c provides additional inputs for sidetone and external options and its output is connected to a DC controlled volume control amplifier IC2b. By the operation of the volume keypad on the keyboard, the microprocessor changes the DC level at pin 10 of the DAC IC16. This linear DC control voltage is applied to a linear/logarithmic converter consisting of IC9a and associated components, and converts the linear voltage to a logarithmic current resulting in a logarithmic volume control function, used to adjust the loudspeaker audio level.

The output from IC2b is applied to the loudspeaker amplifier IC8. The audio amplifier is capable of 8 W output into 2 Ω load and supplies approximately 2 W to the internally fitted 8 Ω speaker.

Transmit audio path

Input amplifier

The local microphone is connected to the 8570 Console by a 7–pin connector on the left side of the unit (P201 pins 3 and 4), and is linked via the microphone loom to connector P1, on the Audio Processor & PSU PCB (refer 04–02585).

The microphone audio is fed through an RF filter network R1 and C1, followed by an analogue switch IC20b (used to inhibit the local microphone during other transmit modes), and then through input resistor R7 to amplifier IC1d, set for a gain of 20 dB (X10). Two other inputs are available to IC1d; the first via the analogue switch IC20a and R6, for remote function (option R), and the second for option PM via R5. Both inputs provide unity gain.

Microphone compressor

From the output of IC1d, the audio is connected to the input of microphone compressor amplifier IC2a, whose gain is controlled to provide a constant output level with changing input levels. In this circuit, the gain controlled element, the resistive cell (delta G), is DC controlled, by internally rectifying the amplified audio applied to pin 2 of IC2a. Above the threshold of AGC, set by resistor R10, an increase in the audio level at the input, proportionally decreases the resistance of the cell. As this is part of the negative feedback, the output level remains constant. R12 and C13 form part of the DC feedback to the amplifier. C11 averages the rectified audio that is applied to the resistive element.

Mixer amplifier

From the compressor (IC2a), the audio is applied to a mixer amplifier IC1a. A second input is also provided for the 300 Hz control tone (present during the transmit mode), and the FSK data signals, detailed later. The output of the mixer, containing the transmit audio and the 300 Hz control tone, is passed to the line driver IC3 via an analogue switch IC20d. The analogue switch disables the transmit audio in the receive mode.

Line driver and transformer

The line driver IC3, has a gain of 3 dB (X1.4) and is a power amplifier with a low output impedance required to drive the step up transformer T1. The high output impedance secondary, in series with R19, provides the constant current feed to the 2 or 4–wire isolating transformers.

2 or 4–wire interface

For the 2–wire line, the transmit audio is applied to the input of the 2–wire interface assembly pins 1 and 2 of connector P8 (see page 4–3, *2 or 4–wire interface and I/P amplifier*). The output of the interface is connected to a modular telephone connector and when terminated into a 600 Ω line, produces an audio level of 0 VU (–10 dBm for a single tone).

For 4–wire operation, the transmit audio is applied to pins 5 and 6 of connector P9, and then to input of the 4–wire interface assembly (see page 4–3, *2 or 4–wire interface and I/P amplifier*). The output of the Tx transformer is connected, via interface cable, to an 8–way connector mounted on the rear of the 8570.

Signalling and microprocessor

Microcontroller bus

The microprocessor (IC7) on the Microprocessor & Display PCB, (refer 04–02586) is an 80C552 and a member of the Intel 80C51 8–bit microprocessor family. It has 256 bytes of internal RAM, no internal program memory, two counter/timers, eight 8–bit ADC inputs, a watchdog timer, I^2C Bus, and an internal clock oscillator.

The microprocessor operates in a conventional 8–bit data, 16–bit address configuration. To minimise the pin count, the low–order address bits are multiplexed with the data on pins 50 to 57 to produce a common 8–bit bus. IC6 is used to latch the low–order address bits to facilitate access to the external nonmultiplexed devices. The address latch enable (ALE) signal (IC7 pin 48) indicates to the latch when the address is present on the bus. The high–order address bits are provided directly from pins 39 to 46 of IC7.

The following external devices are connected to the bus:

- IC5—an EPROM containing control software. The microprocessor selects the EPROM via the program store enable (PSEN) signal (pin 47).
- IC4—a RAM device supplementing the microprocessor's internal RAM. It is selected via the Read or Write signals (IC7 pins 30 and 31) in conjunction with ENRAM (IC7 pin 10).
- IC101—UART; a bidirectional serial to parallel data converter for optional RS232 external control (see page 4–16, *Option R—special purpose I/O*).
- IC3—a triple tone generator used to generate control tone and digital filter clocks (see page 4–9, *300 Hz control tone—generation and detection)*.
- IC2—an I/O port expander used to interface the keyboard and digital display with microprocessor.

A voltage detector and reset generator IC9, resets the microprocessor if the 5 V supply falls below 4.7 V.

Temperature sensing is monitored by the microprocessor at ADC input pin 67, by measuring the voltage at the resistor/thermistor circuit R27 and R26. Battery sensing, is measured at the resistor divider network R24 and R25 and is connected to ADC input pin 68.

An output from the microprocessor (pin 26) is connected to transistor V8 and relay K1. The relay contacts connected to P201 pins 2 and 3 will close when a selcall is received, and can be used to operate an external alarm.

Internal I^2C bus

Additional to the address and data bus lines, the microprocessor IC7 has an I^2C bus (pins 17, 22 & 23) that is connected to the following:

- IC18—Output 8–bit expander connected to IC17, an open collector inverter, located on the Audio Processor & PSU PCB (refer 04–02585), operates the mute on/off, remote/local microphone, Tx On, and external PTT.
- IC19—Input/Output 8–bit expander, located on the Audio Processor & PSU PCB, has inputs to sense the local/remote PTT, PS alarm, PS PTT, mute in, morse (option M), and battery low detection (option SB).
- IC16—DAC, located on the Audio Processor & PSU PCB, enables the microprocessor to select 64 DC steps between 0 to 9 V to control the equalising, gain, volume control, display and LED illumination, and power off control.
- IC11—E^2PROM, located on the Microprocessor & Display PCB, is a nonvolatile memory device that stores the data on the I^2C bus, to retain the program settings between power off and on functions.

Keyboard and display

The keyboard consists of switches on a panel overlay (substrate) forming a 5 x 8 matrix. The rows and columns are connected to the Microprocessor & Display PCB (refer 04–02586) via J1 and J2.

Each row is polled from the microprocessor (IC7), via the I/O port expander IC2, by taking them to 0 V sequentially. One line is driven direct from IC2 pin 10 and the remaining four are buffered by open collector transistors V2–V5 driven from pins 11, 12, 13, and 17.

Switch operation is detected by the corresponding column connections via diodes D3 to D10 to the I/O port IC2 pins 18 to 25. An additional diode D2, connected to the cathode of D3, is part of the Power On circuit (see page 4–2, *Power on–off*). Data indicating the switch closure is encoded and sent via the data bus to the microprocessor.

The Liquid Crystal Display (LCD) consists of 16 x 2 character dot matrix with LED backlighting. It has its own microcontroller, decoder and drive network. Data from the microprocessor IC7, is sent via the I/O port expander IC2, to the display unit.

Part of the display assembly incorporates eight LEDs to indicate certain functions have been selected such as mute, scan etc. Seven of the LEDs are driven by buffer IC1 and one by transistor V1 from the outputs pins 1–4 and 37–40 of IC2.

300 Hz control tone—generation and detection

The 300 Hz control tone is generated by the tone generator IC3 on the Microprocessor & Display PCB (refer 04–02586). The clock frequency of 3.579 MHz is supplied from the oscillator in the Bell 103 Modem IC13 pin 8 (XTALD) and connected, via buffer IC10a, to the three clock inputs of the tone generator (pins 9, 15, and 18).

The internal dividers of IC3 are programmed by the microprocessor via the eight data lines and initiated by the two address lines (A0, A1) to produce a 300 Hz and two 30 kHz square wave outputs.

The first 30 kHz from the tone generator (pin 17) clocks, via IC10f, the digital filters on the Audio Processor & PSU PCB (refer 04–02585) during the receive mode, but changes to about 12 kHz to disable the filters, during the transmit mode.

The 300 Hz square wave from tone generator (pin 10) is applied via an RC network to the input of a low–pass digital filter IC8 (pin 8), and the second 30 kHz from pin 13 is connected to the clock input (pin 1). The 300 Hz runs continuously but the 30 kHz is enabled only when the 300 Hz (sine wave) control tone is required at the output of the low–pass digital filter (TP5). The digital filter is disabled when the 30 kHz is removed. When the filter is enabled, the control tone at the output pin 5, is connected to a mixer amplifier in the Bell 103 Modem IC13. From the output (pin 17), the signal departs the Microprocessor & Display PCB at P2 pin 8 and is connected via an interface cable to P7 pin 8 on the Audio Processor & PSU PCB (refer 04–02585). Here it is applied to the mixer amplifier IC1a, and then continues on the same path as the transmit audio to the output of the 2 or 4–wire link (see page 4–6, *Transmit audio path*).

The 300 Hz generated from the Remote Control Interface 8571, follows the same input path on the 8570 as the receiver audio until the output of the first amplifier IC4a (refer 04–02585). At this point the 300 Hz tone is applied to a 300 Hz band–pass digital filter IC5.

The digital filter consists of two sections: the first connected as an LPF, followed by the second as an HPF. The combination of the two filters overlap each other, resulting in a very narrow band–pass filter centred at 300 Hz. This is to remove the receiver audio and pass only the 300 Hz control signal. The 30 kHz clock is supplied from the tone generator IC3 as detailed earlier.

From the output of BPF (pin 20), the control tone is connected to a DC gain controlled amplifier IC6a, whose gain is set by the microprocessor controlling a DAC (IC16 pin 15) and is set for 6 dB above threshold of the 300 Hz detector.

The gain control element in the amplifier IC6a is a variable resistive cell (delta G) whose resistance decreases as the DC current is increased at the control input pin 1. Because the resistive cell is part of the input circuit to the amplifier, a rise in the DC current to pin 1 will result in an increase in the amplifier gain. Maximum gain is approximately 28 dB and minimum > –25 dB.

From the output of IC6a, the 300 Hz is applied to the detector circuit consisting of IC7a, IC7b, IC7c and associated components. IC7a and IC7b function as comparators, and are connected to a resistor divider chain R40, R41, R43 and R44, to form a window detector. When the control tone exceeds 1.8 V peak to peak, the positive peaks (applied to the noninverted input of IC7a pin 3) produce a positive output pulse from IC7a pin 1, whilst the negative peaks (applied to the inverted input of IC7b pin 6) will produce a positive output pulse from IC7b pin 7.

The outputs are ORed by D2 and D3 and connected to the input of control amplifier IC7c pin 9. Capacitor C31 and resistor R132 form a filter network to average the output pulses from the two comparators. When the average DC on pin 9 exceeds 5 V (threshold), the output pin 8 goes low pulling down D1, which is detected by the microprocessor IC7 pin 18 (see drawing 04–02586).

Signalling modem

The signalling modem is compatible to the Bell 103 format, converting digital data into FSK using frequencies 1070 Hz and 1270 Hz at 550 baud rate.

The modem in the 8570 Console is located on the Microprocessor & Display PCB (refer 04–02586) and designated IC13. It uses a crystal controlled oscillator at a frequency of 3.579 MHz to drive the FSK modulator, digital Rx filters and the FSK demodulator.

Control signals from the microprocessor enable the FSK modulator to transmit data by applying a low to pins 2 (ALB) and 14 (SQT) and a high to pin 13 (O/A). Serial data from the microprocessor's internal UART exits from pin 25 (TxD) and is connected to the FSK modulator pin 11. Output from the modulator is mixed with the 300 Hz control tone and the combined output at pin 17 is applied via the interface cable to P7 pin 8 on the Audio Processor & PSU PCB (refer 04–02585) and connected to the input of mixer amplifier IC1a. At this point it follows the transmit audio path to the output. Upon completion of the data transmission, the control line pin 14 (SQT) is selected high, by the microprocessor, disabling the modulator.

FSK data received via the land line, or radio link, from the 8571 follows the receiver audio path (refer 04–02585) until the output of the low–pass filter IC7d. From here the FSK data is fed via the interface cable to the Microprocessor & Display PCB connector P2 pin 5 (refer 04–02586). Here it is applied to the input amplifier of IC13 pin 15. After amplification it is fed via the Rx digital filters to the FSK demodulator and the carrier detector circuit.

The carrier detector informs the microprocessor by applying a low on pin 27, which indicates that data is being received. From the output of the FSK demodulator, the digital data is applied to the microprocessor UART input pin 24 for processing.

Signalling format

To enable the microprocessors to communicate to each other it is necessary to provide a signalling format that can be recognised by all microprocessors used within the Remote Control 8570/8571 network.

Serial data from the UART in the microprocessor is converted to FSK format in the Bell modem using tone frequencies of 1070 Hz and 1270 Hz at 550 baud. At the receiving terminal, the FSK is restored to digital data by a second modem and is read by the microprocessor from its UART input.

The following outlines the signalling format used in the 8570/8571 system:

- The signalling sequence commences with sending the 300 Hz control tone. After 20 ms the modem, under the control of the microprocessor, sends FSK carrier (bit one) for a period of 20 ms followed by the FSK data. At the end of the data, the 300 Hz continues for a further 2 ms before it is disabled.
- At the receiving end, the microprocessor first detects the 300 Hz followed by the FSK carrier, enabling the microprocessor to be ready to receive data. The data is read, and on completion, the carrier and 300 Hz detector are reset.

The signalling sequence is used for all data transmission including PTT. If the 300 Hz control tone is sent without FSK data from any 8570 Console within the system for a period greater than 100 ms, the microprocessor in the 8571 Interface Unit will automatically select PTT to the transceiver. All remaining microprocessors, connected in the network, will assume PTT is selected, and inhibit all control functions, for the duration of the 300 Hz control tone.

Equalisation and levelling

Automatic equalisation

Before commencing equalisation the operator should reset all gain controlled amplifiers to their default settings (see *8570 and 8571 Remote control operators handbook*).

When an automatic equalisation command is initiated from the keyboard of an 8570 Console, the microprocessor sends, via the signalling modem, a request to the 8571 Interface Unit to transmit a 300 Hz tone for approximately two seconds. During this period, the 8570 microprocessor (IC7, refer 04–02586) commences to lower the gain of the threshold amplifier IC6a, on the Audio Processor & PSU PCB (refer 04–02585) by reducing the DC current on pin 1, until the 300 Hz detector output goes high, (threshold). The microprocessor then resets the control current for a gain setting of 6 dB above threshold, and stores this level.

On completion of setting the gain of the threshold amplifier, but before the end of the two second period, the 8570 microprocessor checks the DC at the ADC input pin 1, (set by resistor divider network R22 and R23 across the 5 V supply) and records this level as the DC offset of the ADC for all future audio measurements. The microprocessor in the 8570 then requests the 8571 to repeat the 300 Hz for five seconds. The level of audio at the output of the 3 kHz LPF IC7d (refer 04–02585) is measured by the microprocessor (IC7) at the ADC input pin 1. The microprocessor will then, via the I^2C bus, change the DC level at pin 16 of IC16, to adjust the gain of the amplifier IC10a, until the level at the monitor point (IC7d) measures 200 mV RMS (560 mV P–P).

The 8570 microprocessor then requests a 2 kHz tone for five seconds from the 8571. Again the level is monitored at the output of IC7d, and the microprocessor adjusts the gain of the equalisation amplifiers IC6b and IC10b for a level of 80 mV RMS, by setting the DC output of the ADC IC16 pin 14 (refer 04–02585). Because of the interaction between the two operations, the sequence will continue until both audio levels are within ±10 mV of the specified levels detailed above.

On completion of the equalisation, the word optimal will be displayed on the LCD, indicating accurate compensation. However if the tones cannot be set to within the specified tolerance, because one or both gain settings are at minimum or maximum, the microprocessor will terminate the sequence and display complete, indicating that equalisation is acceptable.

Any additional 8570s, connected in parallel on the same line, will also need to perform their own local equalisation sequence, initialised from their keyboards.

Auto levelling

The purpose of the automatic levelling is to be able to have the gain, equalisation and threshold to cope with the attenuation of a long line, yet not to be overdriven into distortion when monitoring or communicating (via the intercom facility) with a 8570 connected in parallel on the same line. When audio signals are received that include the 300 Hz tone, the received signal is sampled every 100 µs. If the audio level exceeds 3 V P–P for more than five times during the period the 300 Hz is active, the microprocessor will reduce the threshold, gain and equalisation settings to 24%, 20%, and 0% respectively. When the 300 Hz tone is removed, the microprocessor resets the gains to the levels previously determined during the automatic equalisation program.

Auto levelling will not operate when in the transmit mode, sending data, or in the ‘setup mode’.

Options for 8570

This section of the manual contains a technical description of the remote control options and should be read in conjunction with the following diagrams:

Description	PCB Assembly	Circuit Diagram
Microprocessor & Display	08–03978	04–02586
Audio Processor & PSU	08–03977	04–02585
Battery Charger	08–04286	04–02712

Option M—morse facility

(15–10374–000)

Option M provides an input for connecting a morse key for morse facility. The addition required for option M, is as follows:

- Option M loom 08–03261

A 3.5 mm jack socket (J208) where provided, is fitted on the rear panel, for connecting the morse key to the 8570.

J208 (refer 04–02585) is connected to the I^2C bus via I/O 8–bit expander IC19. The PTT and audio tone are generated by the microprocessor whenever the morse key is pressed.

Option PH—headphone output

(15–10375–000)

Option PH provides an output facility to operate headphones. The addition required for option PH is as follows:

- 6.35 mm jack socket, resistors R601 and R602, and capacitor C601

The jack socket is wired to the output of the audio amplifier IC8 (refer 04–02585) via attenuating resistors R601 and R602. When the headphones are plugged in, a contact on the jack socket disables the loudspeaker.

Option PM—miscellaneous facilities

(15–10376–000)

Option PM provides Tx audio input, Rx audio output, and PTT facility, plus a DC supply (A rail). The addition required for option PM, is as follows:

- Option RS loom 08–05091–001

All remaining components used for this option are already fitted to the Microprocessor and Display PCB (refer 04–02585).

Tx audio is applied via pin 3 of the I/O connector P204, to the microphone input amplifier IC1d on the Audio Processor & PSU PCB (refer 04–02585). Rx audio is taken from receiver audio path at the output of the 300 Hz notch filter IC12b (before the mute gate), and is connected to pin 2 of the I/O connector P204.

PTT function is available by applying a ground to pin 6 (P204), and is detected by the microprocessor via IC19 connected to the I^2C bus.

DC supply from ‘A’ rail is available at pin 8 and ground at pin 1 on the option I/O connector.

Wiring to the 10–way connector (P204) mounted at the rear of the 8570 is detailed on page 2–4, *Panel connectors for 8570 Console*.

Option R—special purpose I/O

(15–10377–000)

Option R is an input/output interface designed to operate with external equipment requiring special facilities.

The additions required for option R, are as follows:

- Remote Control and Filter PCB 08–03127
- Remote Control and Filter Cable 08–03170

Transmit audio from the external equipment is connected to pin 11 P202 on the Audio Processor & PSU PCB (refer 04–02585) and is applied via the interface cable, Filter PCB, and an analogue switch IC20a, to the microphone input amplifier IC1d. Sidetone is available if link ‘RCIa’ is fitted, connecting the audio to mixer amplifier IC1c, part of the receive audio path.

When a ground is applied to the PTT line (pin 2 of P202), the microprocessor detects the PTT command via IC19 and the I^2C bus, then enables the analogue switch IC20a and selects PTT.

The receiver audio is taken from the receiver path after the mute gate IC20c and is connected via buffer amplifier IC1b, to pin 3 of P202. By removing link ‘RCIb’in the receiver path (o/p mute gate to amplifier IC1c), it is possible to operate an external mute gate connected between pins 12 and 13 of P202.

An external loudspeaker can be fitted between pins 1 and 9 and is connected to the output of the audio amplifier IC8, the level of which is controlled by the keyboard on the 8570.

The I^2C bus on pins 6, 7, and 14 of P202 are not enabled but are included for possible future use.

DC supply from ‘A’ rail is available at pin 15 and ground at pin 9 on P202.

RF filtering is provided on all input and output lines.

Wiring to the 15–way connector (P202) mounted at the rear of the 8570, see page 2–4, *Panel connectors for 8570 Console*.

Option RS—RS232 Interface

(15–10378–000)

The option RS enables equipment using the RS232 format to communicate with the Remote Control Console 8570.

The additions required to the Microprocessor & Display PCB 08–03978, are the following:

- UART integrated circuit IC101 complete with 3.6864 MHz crystal Z101, capacitors C101 and C102, and resistor R101
- RS232 level translator IC102 complete with capacitors C103 to C106
- connector P102
- RS232 interface cable 08–04115

Serial data from the external equipment is applied via the interface cable to input pin 8 (RxD) of the level translator IC102 on the Microprocessor & Display PCB (refer 04–02586), and the buffered data (pin 9) is applied to pin 2 of the UART IC101. The data is converted from serial to parallel and applied via the data bus to the microprocessor.

Parallel data from the microprocessor is applied via the data bus to the UART IC101 and the resulting serial data at pin 3 (TxD) is connected to pin 10 of the level translator IC102. The output at pin 7 is connected via the interface cable to the external equipment.

The CTS and RTS control lines connected between the external equipment and the UART via the translator are part of the enable and handshake mechanism used when transferring data.

To enable the RS232 facility and set up the baud rate etc, see the *8570 and 8571 Remote control operators handbook*.

For details on wiring to the RS232 connector (P101) mounted at the rear of the 8570, see page 2–4, *Panel connectors for 8570 Console*.

Option SB—standby battery

(15–10379–000)

An optional battery backup facility can be fitted to ensure operation during a power failure. This consists of a 12 V 13 Ah rechargeable battery, and a battery charger, internally fitted in the 8570. This will keep the equipment operational for approximately five hours.

The 14 V AC supply from transformer T2 (refer 04–02585), is applied to diodes D1 and D2 on the Battery Charger PCB (refer 04–03011), to form a full wave rectifier circuit, which is connected to filter capacitor C1.

The integrated circuit IC1, and is its associated components, are designed to supply a dual level charge system to the battery. In the first charge state, a current of 300 mA is applied to the battery and remains at this level until the battery voltage reaches 14.7 V. At this point, the second charge state is selected, and the battery receives a float current of 30 mA, to prevent overcharging. Battery voltage sensing is achieved by IC1 pin 13 monitoring the voltage at the junction of resistors R9 and R10 (part of the divider chain across the battery), and the maximum current limit is set by parallel resistors R1 and R2.

If the battery voltage is below 8 V when the mains power is applied, possible damage to the battery could result if charged at the high rate (300 mA). Consequently, an alternative DC output is supplied from IC1 pin 11 and connected via resistors R6 and R7 to the battery to supply a low current turn on until the battery reaches 8 V, then the first charge state is initiated.

5 Technical description—8571

This chapter contains a technical description of the:

- backplane & power supply (5–2)
- receive path (5–3)
- transmit path (5–5)
- signalling and microprocessors (5–8)
- automatic equalisation (5–12)
- options (5–14)
- accessories (5–16)

This chapter should be read in conjunction with Chapter 9, *Drawings*.

Backplane and power supply

The Backplane PCB provides the interconnections between the PCBs fitted to the 8571. It contains the Tx and Rx audio buses, the I^2C bus, the 30 kHz clock, 300 Hz detect, and the regulators for the DC supplies.

The 8571 operates on 12 or 24 V. For 24 V operation, the DC is connected to two regulators (refer 04–02691): IC1 for 5 V (+5 rail) and IC2 for approximately 14 V (A rail). For 12 V operation, only IC1 is required and IC2 is bypassed by D4. Reverse voltage protection is achieved by the series diodes D1 and D2.

The Backplane PCB also provides connectors P6 and P105 for the fitting of links to disable the unused lines on the Dual Line Equaliser PCBs. Also P303 and P304 provide the connectors for fitting the RS232 strapping.

All external input/output connections to the 8571, are made via interface cables connected to the Backplane PCB. Some interface cables include isolation transformer assemblies, which are required for 2 or 4–wire operation.

Receive audio path

Rx audio from transceiver

The pre–mute receiver audio, is connected from pin 17 of the 25–way remote control connector fitted to the rear of a transceiver via an interface cable to the 8571 Backplane PCB connector P1 pin 8 (refer 04–02691). From here, it is connected to the input of transformer T1 on the Microprocessor & Tcvr Interface PCB (refer 04–02690), via P1 pin 16a (ground pin 14a).

300 Hz notch filter and audio compressor

From the secondary of transformer T1 on the Microprocessor & Tcvr Interface PCB (refer 04–02690), the receive signal passes to an analogue changeover switch IC2c and connects to the input of a 2–section digital filter, consisting of IC4, IC3a, IC3b, and associated components to produce a 300 Hz notch filter. It has unity gain at frequencies above 300 Hz, but provides high attenuation (> –40 dB) at 300 Hz. IC4 is a dual active filter and is driven by a 30 kHz external clock generated from the IC16. The high–pass (pin 18) and the low–pass (pin 20) outputs of the first active filter are phase mixed at the input of amplifier IC3b, resulting in the required notch response. The output from IC3b is applied to the second active filter and again the high and low–pass filter outputs are phase mixed at the input of IC3a. The two notch filters are slightly offset to each other to ensure the complete rejection of any signal on or close to 300 Hz, that may possibly corrupt the operation of the system.

From the output of IC3a, the audio is fed via a second analogue changeover switch IC2a to the input of the compressor amplifier IC7, whose gain is controlled to maintain a constant output level for varying input levels.

In this circuit, the gain controlled element (resistive cell delta G), is DC controlled, by internally rectifying the amplified audio that is applied to pin 15 of IC7. Above the threshold of AGC, set by resistor R29, an increase in the audio level at the input proportionally decreases the resistance of the cell. As this is part of the negative feedback, the output level remains constant. R26 and C18 form part of the DC feedback to the amplifier. C21 averages the rectified audio that is applied to the resistive element.

The receiver audio at the output of IC7 is connected to a mixer amplifier in the Bell 103 Modem IC6 pin 1, and the output (pin 17) is coupled to pin 30a of connector P1, and is designated Rx Audio Bus.

Rx audio bus and audio gate

From the Rx Audio Bus line, the signal is fed via the Backplane PCB to the Dual Line Equaliser PCB (refer 04–02541), via connector P1 pins 30a and 30b. From here it continues via an isolating transformer T2, through the audio gate IC1 pins 1 and 2, to the input of the line driver IC102 pin 4.

The audio gate disables the Rx audio to the line driver during the transmit mode.

Line driver and hybrid

The line driver IC102 on the Dual Line Equaliser PCB (refer 04–02541), has unity gain and is a power amplifier with a low output impedance. The output is connected to the Line Isolation Unit, via pins 28a and 28b of P1. In the 2–wire system, the transmit and receive audio share the same land line between the 8570 and the 8571. By the use of a Hybrid circuit, it is possible to combine the two signals into one path and at the same time to isolate the transmit and receive paths from each other.

The hybrid, located on the Dual Line Equaliser PCB (refer 04–02541), consists of a bridge network. Resistors R106 and R107 form the top two parts of the bridge and the terminated land line plus the resistor/capacitor combination of R108/C101 form the lower third and forth sections. The two opposite phased outputs of the receiver line driver IC102, are connected to the top and bottom points of the bridge; pin 5 to the junction of R106 and R107, and pin 8 to the junction of R108/C101 and one side of the line (pin 28b). The two remaining bridge points, R106 to line pin 28a and R107 to R108/C101 are connected to the differential inputs of amplifier IC101a via resistors R103 and R104.

When the land line impedance equals the R108/C101 combination, the two receive signals applied to IC101a will be of equal amplitude and phase. Because they are connected to the input of a differential amplifier, the signals cancel and produce no output at pin 1 of IC101a. However the line impedance will rarely equal the R108/C101 combination, but will still result in sufficient cancellation of the receiver signal, to prevent the overloading of the transmit path, and allow the detection of the 300 Hz control tone when transmitted from the 8570 Console.

2 or 4–wire interface

For the 2–wire interface, the receiver audio is applied to pins 1 and 2 of the connector P2 for line one, (lines 2, 3 and 4 use connectors P5, P101, and P104) located on the Backplane PCB (refer 04–02691), and then via an interface cable to the 2–wire Interface assembly.

The 2–wire interface consists of an isolating transformer, a fuse, and an overvoltage protection device, assembled in a fully insulated box. It is Austel approved. The output of the interface is connected to a modular telephone connector, and when terminated into a 600 Ω, line produces an audio level of 0 VU (–10 dBm for a single tone).

For the 4–wire interface, the receiver audio is applied to pins 5 and 6 of connector P3 (lines 2, 3, and 4 use P4, P102, and P103 respectively) and then via an interface cable to the 4–wire interface assembly.

The 4–wire interface consists of two isolating transformers (providing separate Tx and Rx paths) and include RF filter capacitors. The output of the Rx transformer connects via interface cable to an 8–way connector mounted on the rear of the 8571.

Transmit audio path

2 or 4–wire interface

When used with the 4–wire link, the transmit audio from the 8570 Console (line 1) is connected to pins 1 & 2 of an 8–way connector located at the rear of the 8571 Interface Unit. It is applied via the Backplane PCB to the 4–wire interface assembly (see page 5–4, *2 or 4–wire interface*). At the output of the interface unit, the audio is connected via an interface cable to the Backplane PCB and then to the Dual Line Equaliser PCB (refer 04–02541).

With the 2–wire link version, the transmit audio from the 8570, is received by land line and is terminated into a modular telephone connector fitted on the rear panel of the 8571, and is connected to the 2–wire interface assembly (see page 5–4, *2 or 4–wire interface*). At the output of the interface unit, the audio is connected via an interface cable to the Backplane PCB and then to the Dual Line Equaliser PCB.

Hybrid

For a detailed description of the Hybrid in Receive mode, see page 5–4, *Line driver and hybrid*. In Transmit mode, the operation is very simple. The transmit audio for the 2–wire version is applied from pins 28a and 28b of connector P1 (refer 04–02541) to the input of differential amplifier IC101a, via resistors R103 and R104. As the signals at each input are opposite in phase, IC101a will amplify the signal by 6 dB (X2).

Gain and equalisation stage

From the output of IC101a (refer 04–02541), the transmit audio is passed to a DC gain controlled amplifier IC103a, whose gain is set by the microprocessor to compensate for the losses in the land line or radio link.

The gain control element in the amplifier IC103a is a variable resistive cell (delta G) whose resistance decreases as the DC current is raised at the control input pin 1. In this circuit, maximum gain occurs when the cell is at its highest resistance (pin 1 is at zero current). AC gain is set by the input resistor R117, and the total feedback resistance of R123 in series with the internal 20 kΩ resistor, resulting in a gain of approximately 14.5 dB (X5). As the resistive cell is connected in parallel to the feedback resistance, an increase in DC current to pin 1 will result in a decrease of amplifier gain. Minimum gain is limited by the internally fitted 20 kΩ in series with the cell, being about 3.5 dB (X1.5).

From the gain controlled amplifier, the audio is passed to the first of two DC controlled equalisation amplifiers IC103b & IC104b. Both amplifiers operate in a similar manner to amplifier IC103a described above but are designed to give a DC controlled treble boost, to compensate for high frequency loss on the land line. As both equalisers are almost identical, only a description of the first unit is necessary, except where detailed.

In this configuration, the resistive cell is in series with a 20 kΩ resistor and a 1 nF capacitor C113. The resulting series network is connected in parallel to the input resistor R124. Because the cell is in the input circuit, and not part of the feedback network as used in the amplifier IC103a described previously, minimum gain occurs when the cell has a high resistance (DC current on pin 16 at zero). This has minimum effect on the AC gain of the amplifier, therefore the gain is set by the feedback resistor R127 in conjunction with input resistor R124. At this point, the amplifier has a flat AC response: the first (IC103b) has unity gain, while the second amplifier (IC104b) attenuates the signal by 6 dB.

As the DC current on pin 16 of IC103b and IC104b is raised by the microprocessor controlled DAC IC2, the resistance of the cell reduces. However, due to the AC reactance of the 1 nF (C113 & C124), the gain increase will be proportional to rise in frequency. For example there will be approximately 2 dB increase at 100 Hz, rising to about 17 dB at 2 kHz for the first amplifier IC103b and, because of different resistor values, about 11 dB for the second amplifier IC104b. The combination of the two amplifiers will have a overall minimum gain of –6 dB (X0.5) and a maximum gain of 28 dB at 2 kHz (X25). At the highest gain setting, the gain will continue to rise with frequency until, at about 10 kHz, it will commence to roll off due to the influence of feedback capacitors C117 and C127.

Low–pass filter, audio gate and Tx audio bus

Because the equalisation amplifiers have a rising gain with frequency (except at minimum gain) it is necessary to connect the output to a low–pass 3 kHz filter, to remove any high frequency noise that may result from the high gain in the equalisation amplifiers. IC105a and its associated components form an active 3–pole LPF of conventional design.

At the output of the LPF, the audio is fed via a audio gate IC1, to the primary of transformer T1. From the secondary the signal connects to the Backplane PCB via P1 pins 32a and 32b, and is designated Tx Audio bus.

300 Hz notch filter

From the Backplane PCB (04–02691), the Tx audio bus is connected to the Microprocessor & Tcvr Interface PCB (refer 04–02690) connector P1 pins 32a and 32b. It continues via an analogue changeover switch IC2c selected to a 2–section digital filter, consisting of IC4, IC3b, IC3a and associated components, to produce a 300 Hz notch filter. It has unity gain at frequencies above 300 Hz, but produces high attenuation (> –40 dB) at 300 Hz. This removes the 300 Hz control tone from the final transmitted audio.

IC4 is a dual active filter and is driven by a 30 kHz external clock generated from the tone generator IC16. The high–pass (pin 18) and the low–pass (pin 20) outputs of the first active filter are phase mixed at the input of amplifier IC3b, resulting in the required notch response. The output from IC3b is applied to the second active filter and again the high and low–pass filter outputs are phase mixed at the input of IC3a. The two notch filters are slightly offset to each other, to produce about a 25 Hz bandwidth rejection centred at 300 Hz.

Transmit audio to transceiver

At the output of the 300 Hz notch filter (IC103b), the Tx audio is connected by a changeover analog switch (IC2a) to a simple passive LPF consisting of R23 and C8, then to the primary of isolating transformer T2. From the secondary, the audio is connected (pins 13a & 15a P1) via an interface cable to the transceiver Tx audio input.

Signalling and microprocessor

Microcontroller bus

The microprocessor (IC12) on the Microprocessor & Tcvr Interface PCB (refer 04–02690), is an 80C552 and is a member of the Intel 80C51 8–bit microprocessor family. It has 256 bytes of internal RAM, no internal program memory, two counter/timers, eight 8–bit ADC inputs, a watchdog timer, I^2C Bus, and an internal clock oscillator.

The microprocessor operates in a conventional 8–bit data, 16–bit address configuration. To minimise the pin count, the low–order address bits are multiplexed with the data on pins 50 to 57 onto a common 8–bit bus. IC13 is used to latch the low–order address bits to facilitate access to the external nonmultiplexed devices. The address latch enable (ALE) signal (IC12 pin 48) indicates to the latch when the address is present on the bus. The high–order address bits are provided directly on pins 39 to 46 of IC12.

The following external devices are connected to the bus:

- IC14—an EPROM containing control software. The microcontroller selects the EPROM via the program store enable (PSEN) signal (pin 47).
- IC15—a RAM device supplementing the microcontroller's internal RAM. It is selected via the Read or Write signals (IC12 pins 30 and 31).
- IC16—a triple–tone generator used to generate control tone and digital filter clocks (see page 5–9, *300 Hz control tone—generation and detection*).

A voltage detector and reset generator IC9 resets the microprocessor if the 5 V supply falls below 4.7 V.

Connected to input ports of IC12 pins 1, 66, 67, and 68 is a binary switch designated mode select.

Temperature sensing is monitored by the microprocessor at ADC input pin 62 by measuring the voltage at the resistor/thermistor circuit R36 and R37. Battery voltage sensing is measured at the resistor divider network R38 and R39 and is connected to ADC input pin 64.

Internal I^2C bus

Additional to the address and data bus lines, the microprocessor has an I^2C bus that is connected to the backplane and is used to operate the following:

- IC2—DAC located on the Dual Line Equaliser PCB (08–03905) enables the microprocessor to select 64 DC steps between 0 to 9 V to control the threshold, gain, and equalisation amplifiers.
- IC3—I/O 8–bit expander, located on the Dual Line Equaliser PCB, which has outputs to control the Tx and Rx audio paths.

The I^2C bus is also used to communicate to the General Purpose I/O PCB with Option I/O GP I/O (see page 5–14, *Options for 8571*).

300 Hz control tone—generation and detection

The 300 Hz control tone is generated by the tone generator IC16 on the Microprocessor & Tcvr Interface PCB (refer 04–42690). The clock frequency of 3.579 MHz is supplied from the oscillator in the Bell 103 Modem IC6 and connected via buffer IC1e to the three clock inputs of the tone generator (pins 9,15, and 18).

The internal dividers of IC16 are programmed by the microprocessor via the eight data lines and initiated by the two address lines (A0,A1) to produce a 300 Hz and two 30 kHz square wave outputs.

The first 30 kHz from the tone generator (pin 17) clocks the notch and digital filters (04–02541), and runs continuously.

The 300 Hz square wave from the tone generator pin 10 is applied via an RC network to the input of a low–pass digital filter IC17 (pin 8), and the second 30 kHz from pin 13 is connected to the clock input (pin 1). The 300 Hz (pin 10) runs continuously but the 30 kHz (pin 13) is enabled only when the 300 Hz sine wave is required at the output of the low–pass digital filter (pin 5). The digital filter is disabled when the 30 kHz is removed.

From the output of the filter (IC17), the control tone is connected to the input of the mixer amplifier in the Bell 103 Modem IC6. From the output (pin 17), the signal is passed via connector P1 pin 30a to the Rx audio bus on the Backplane PCB, and continues on the same path as the Rx audio through the Dual Line Equaliser PCB (see page 5–3, *Receive audio path*) to the output of the 8571.

The 300 Hz received from the 8570 Console, is connected via the 2 or 4W Interface and Backplane PCB to the Dual Line Equaliser PCB (refer 04–02541) and follows the same path as the transmit audio to the output of the hybrid amplifier IC101a (see page 5–5, *Transmit audio path*). At this point, the 300 Hz control tone (originating from the 8570 when in transmit mode) is applied to a 300 Hz band–pass digital filter IC106.

The digital filter consists of two sections: the first connected as an LPF, followed by the second as an HPF. The combination of the two filters overlaps each other, resulting in a very narrow BPF centred at 300 Hz. This removes the transmit audio but retains the 300 Hz control signal. The 30 kHz clock is supplied from the tone generator IC16 on the Microprocessor & Tcvr Interface PCB.

From the output of the BPF, the control tone with the transmit audio removed, is passed to a DC gain controlled amplifier IC104a, whose gain is set by the microprocessor for 6 dB above threshold of the 300 Hz detector described below.

The gain control element in amplifier IC104a is a variable resistive cell (delta G) whose resistance decreases as the DC current is increased at the control pin 1 (controlled by the microprocessor via DAC IC2). Because the resistive cell is part of the input circuit to the amplifier, a rise in the DC current at pin 1 of IC104a will result in an increase in the amplifier gain.

From the output of the gain controlled amplifier, the 300 Hz is applied to the detector circuit consisting of IC107a, IC107b, IC105b and associated components. IC107a and IC107b function as comparators, and their DC inputs are set by the resistor divider chain R2, R3, R4 and R5, connected across the 10 V supply to form a window detector. When the control tone exceeds 2.0 V P–P, the positive peaks applied to the noninverting input (pin 3 of IC107a) produce a positive output pulse at pin 1. The negative peaks applied to the inverting input (pin 6 of IC107b) will produce a positive output pulse at pin 7. The outputs are ORed by D101 and D102 and connected to the input of control amplifier IC105b. Capacitor C130 and resistor R137 form a filter network to average the output pulses from the two comparators. When the average DC on pin 5 exceeds 5 V (threshold), the output pin 7 goes high. The 300 Hz detect line from IC105b, is inverted by IC5b and connected to the 300 Hz detect bus, on the Backplane PCB via connector P1 pin 31b.

From the Backplane PCB, the 300 Hz detect is fed to the Microprocessor & Tcvr Interface PCB (refer 04–02690) via connector P1 pin 31b. It is inverted by IC1a and is detected by the microprocessor on pin 18.

Signalling modem

The signalling modem is compatible to the Bell 103 format, converting digital data into FSK using frequencies 1070 Hz and 1270 Hz at 550 baud rate.

The modem in the 8571 is located on the Microprocessor & Tcvr Interface PCB (refer 04–02690) and designated IC6. It uses a crystal controlled oscillator at a frequency of 3.579 MHz to drive the FSK modulator, digital Rx filters and the FSK demodulator.

Control signals from the microprocessor enable the FSK modulator to transmit data by applying a low to pins 2 (ALB) and 14 (SQT) and a high to pin 13 (O/A). Serial data from the microprocessor's internal UART, exits from pin 25, and is connected to the FSK modulator pin 11. Output from the modulator is mixed with the 300 Hz control tone and the combined output signal at pin 17, follows the receive path to the output of the 8571 (see page 5–3, *Receive audio path*). The receive audio is disabled during the sending of FSK data, and on completion, the modulator is disabled by the control line pin 14 (SQT) going high controlled by the microprocessor.

FSK data from the 8570 Console received via the land line or radio link, follows the transmit audio path to the Tx audio bus. From pin 32a of P1, the FSK data is applied to the input amplifier of the modem IC6 pin 15 (RXA2). After amplification, it is fed via the Rx digital filters to the FSK demodulator and the carrier detector circuit. The carrier detector informs the microprocessor by applying a low on pin 13 (CD), that data is being received. From the output of the FSK demodulator, the digital data is applied to the microprocessor input pin 24 (RXD) for processing.

Signalling format

All microprocessors within the Remote Control 8570/8571 network use the same format, (see page 4–11, *Signalling format)*.

Transceiver control logic

The transceiver is connected via an interface cable to a 25–way D connector located on the back panel of the Remote Control Interface.

A separate I^2C bus system from the 8571 Interface Unit is used to control the transceiver microprocessor.

The 8571 microprocessor on the Microprocessor & Tcvr Interface PCB, has a separate I^2C ‘data in’ (pin 17) and ‘data out’ (pin 8) lines and these are combined at the buffer stages IC5b, IC5f, and V4 before leaving the PCB. An interrupt command from the microprocessor (pin 7) is connected to the transceiver via buffer IC5a and transistor V3.

Additional control lines from the microprocessor are connected via buffers to the transceiver, IC5e plus V1 to operate the ‘power on’ and IC5d plus V2 to activate the PTT.

The receiver audio is connected to the Microprocessor & Tcvr Interface PCB receive path via isolating transformer T1, and can be selected, by links, for post–mute or pre–mute (the latter is normally selected).

Transmit audio, originating from the 8570, is connected from the Tx audio bus on the Microprocessor & Tcvr Interface PCB to the transceiver via isolating transformer T2.

All commands to and from the transceiver, except PTT and ‘power on’ are sent via the I^2C bus, e.g. channel change, channel programming, scan etc.

Automatic equalisation

Single site

When a request to the 8571 Interface Unit to commence equalisation is initiated, either by the setting of the mode ‘select’, located on the Microprocessor & Tcvr Interface PCB, or by a request sent from the 8570 Console (see *8570 and 8571 Remote control operators handbook* for details), the microprocessor in the 8571 carries out the following procedure.

The microprocessor sends, via the signalling modem, a request to the 8570 to transmit a 300 Hz tone, for approximately two seconds. During this period, the 8571 microprocessor, first sets the 300 Hz threshold amplifier IC104a (on the Dual Line Equaliser PCB) to maximum gain. It then commences to decrease the gain, by reducing the DC current on pin 1, until the 300 Hz detector output goes low (IC105b pin 7). The microprocessor then resets the control current for a gain of 6 dB above threshold, and stores this gain setting.

The microprocessor then requests the 8570 to repeat the 300 Hz transmission for five seconds, the microprocessor measures the level of audio on the Rx audio bus line (output of modem IC6) by using its internal ADC at pin 63. The microprocessor will then change the DC level output of the DAC IC2 pin 14, (on the Dual Line Equaliser PCB), which adjusts the gain of the amplifier IC103a. This continues until the level on the Rx audio bus line measures 200 mV RMS.

The microprocessor then requests, from the 8570, a 2 kHz tone for five seconds. Again the level is monitored on the Rx audio bus, and the microprocessor adjusts the gain of the equalisation amplifiers IC103b and IC104b, by adjusting the DC output of the DAC IC2 pin 15, for a level of 80 mV RMS on the audio bus line.

Because of the interaction between the two operations, the sequence will be repeated for a maximum of twenty attempts to set both audio levels within ±10 mV of the specified levels detailed above.

If the ±10 mV tolerance is attained, the 8571 microprocessor will instruct the 8570 to display ‘Optimal’, however, if after the twenty attempts the tolerance limits are not achieved, the microprocessor will instruct the word ‘completed’ to be displayed. If the latter is displayed, it means the line has been equalised and although it did not achieve the optimum settings, performance should be satisfactory.

If the 300 Hz threshold fails to detect any 300 Hz tone after six attempts, the microprocessor will abort the process and instruct the microprocessor in the 8570 Console to display ‘failed’.

Split site

The split–site configuration can be either daisy chain or star. With either of these configurations, the first 8571 will follow the equalisation program, as detailed for a single site (see page 5–12, *Single site*), continued by equalisation between all remaining units. The 8570 will display the following, as each section is completed.

For daisy chain split site:

Message	**Action**
‘Split wait...’	equalising Master 8571 to Rx 8571
‘Split 50% done’	equalising Rx 8571 to Master 8571

For star split site:

Message	**Action**
‘Split wait...’	equalising Master 8571 to Rx 8571
‘Split 25% done’	equalising Master 8571 to Tx 8571
‘Split 50% done’	equalising Rx 8571 to Master 8571
‘Split 75% done’	equalising Tx 8571 to Master 8571

When the 8570 reports on the completion of the equalisation of the 8571s in the split–site configuration, only the results of the last 8571 to be equalised will be displayed i.e. ‘optimal’ or ‘completed’. However should any 8571s fail to equalise, the process will be aborted and ‘failed’ will be displayed.

Options for 8571

This section of the manual contains a technical description of the remote control options and should be read in conjunction with the following diagrams:

RCI backplane	04–02691
Dual Line Equaliser	04–02541
General purpose input/output	04–02852

Option ML—fit 3 or 4–line capability

(15–10380–000)

Option ML provides two additional input/output lines required for more complex systems.

The additions required for option ML are as follows:

- Dual Line Equaliser PCB 08–03905
- 2–Wire or 4–Wire Line Isolating assembly (quantity two) 08–03816 (2W) and/or 08–03995 (4W)
- Additional connectors and RF bypass capacitors fitted to the Backplane PCB

The Dual Line Equaliser PCB providing input/output lines 3 and 4 is identical to the PCB already fitted for input/output lines 1 and 2 (see page 5–3, *Receive audio path* and page 5–5, *Transmit audio path*).

To enable the microprocessor to individually control either PCB, the ADC and input/output expander on each PCB is provided with a separate address. This is set for each assembly when they are fitted to the appropriate connector on the Backplane, and is applied to P1 pins 10a, 10b, 11a, and 11b (0, 1, 1, 0 for lines 1 and 29) (0, 0, 1, 0 for lines 3 and 4).

Option RS—RS232 port

(15–10391–000)

The RS232 option provides ARQ and FEC data capabilities when used with type 8580 modem.

The RS232 interface consists of a General Purpose I/O PCB 08–04644 fitted with a microprocessor (IC103) 80C552, and is a member of the Intel 80C51 8–bit microprocessor family. It has 256 bytes of internal RAM, no internal program memory, two counter/timers, eight 8–bit ADC inputs, a watchdog timer, I^2C Bus, and an internal clock oscillator.

The microprocessor operates in a conventional 8–bit data, 16–bit address configuration. To minimise the pin count, the low–order address bits are multiplexed with the data on pins 50 to 57 onto a common 8–bit bus. IC104 is used to latch the low–order address bits to facilitate access to the external nonmultiplexed devices. The address latch enable (ALE) signal (IC103 pin 48) indicates to the latch when the address is present on the bus. The high–order address bits are provided directly on pins 39 to 46 of IC103.

The following external devices are connected to the bus:

- IC105—an EPROM containing control software. The microprocessor selects the EPROM via the program store enable (PSEN) signal (pin 47).
- IC106—a RAM device supplementing the microprocessor's internal RAM. It is selected via the microprocessor's Read or Write signals (pins 30 and 31) in conjunction with address lines A13 & A15 used for chip select.
- IC107—UART, a bidirectional serial to parallel data converter.

The voltage detector and reset generator IC102 reset the microprocessor if the 5 V supply falls below 4.7 V.

Two 8–bit mode switches connected to the microprocessor input ports pins 7 to 14 (S101) and pins 24 to 29 (S102), select the RS232 format for correct operation of the external equipment (see the *8570 and 8571 Remote control operators handbook)*.

The microprocessor on the Microprocessor & Tcvr Interface PCB (IC12) communicates to the RS232 microprocessor (IC103) via the I^2C bus, and is connected from the Backplane to the General Purpose I/O PCB via connector P1 pins 8a, 8b, and 7b and applied directly to the microprocessor pins 19 (INT IN), 22 (SCL), and 23 (SDA). The interrupt output line from pin 20 (INT OUT) is combined via buffer IC101a and transistor V102 at P1 pin 7b, resulting in a bidirectional Interrupt line at this point.

The operation control logic within the UART IC107, receives operation commands from the microprocessor and generates appropriate signals to internal sections to control device operation. The commands include the baud rate, parity selection, data width, and stop bit parameters set by the 8–bit mode switch S101. The commands permit the UART to communicate with the microprocessor via the data bus buffer.

Serial data from the external equipment is applied via the option interface cable to input pin 17 (RXD) of the level translator IC108, and the buffered data (pin 16) is applied to pin 2 of the UART IC107. The data is converted from serial to parallel and applied via the data bus to the microprocessor.

Parallel data from the microprocessor is applied via the data bus to the UART IC107 and the resulting serial data at pin 3 (TxD) is connected to pin 15 of the level translator IC108. The output at pin 18 is connected via the interface cable to the external equipment.

The CTS and RTS control lines connected between the external equipment and the UART via the translator are part of the enable and handshake mechanism used when transferring data.

To set up the baud rate, parity selection etc, see the *8570 and 8571 Remote control operators handbook*.

The analogue input and output circuits connected to the microprocessor IC103, plus the DSR and DTR lines connected to the level translator are not enabled but are included for possible future use.

Option I/O GP I/O

(15–10392–000)

The general purpose I/O option (part of the Input/Output PCB 08–04644) provides for the remote control of electrical equipment via isolating relays, and includes four logic input lines.

Data from the I^2C bus is applied to the input/output expander IC201 (pins 13, 14, 15) and the lines connected to pins 1, 2, and 3, set the address for IC201 (0, 0, 0, on the backplane PCB). IC201 has four input and four output ports. The output ports, pins 9 to 12, are connected via drivers (IC202) to relays K201 to K204, whose changeover contacts are connected to P1 (pins 17 to 24). The four (active low) logic inputs from P1 pins (27a/b, 28a/b) are applied via buffers (IC203) to inputs ports pins 4 to 7, and in the off state, can be between 5 V to 50 V.

For wiring connections to the 15–way connector, see page 2–7, *Rear panel connectors for 8571 Interface*.

Accessories

ALE split–site switch cable

(15–00751)

General description

When an ALE Controller 9300 is used in a split–site configuration, it must be located at the receiver site. This means that the FSK data output from the 9300 has to be switched (when it initiates a transmit command) through the 8571 Remote Control Interface situated at the receiver site. It is then switched via land line or radio link to the 8571 at the transmitter site, and then finally to the transmitter audio input. To achieve this, a special cable containing the switch circuit is used to connect together the transceiver, 9300 and the 8571 at the receiver site.

This special cable, called the ALE/8571 split–site switch cable (part number 08–05748), switches the audio input line of the 8571 from the receiver output to the transmit 9300 FSK output under PTT control.

Technical description

(04–03067)

The remote PTT line from the remote control P2/2 is connected to the control inputs of analogue switches IC1 pins 12 & 13 on the PCB 08–05748.

In receive, the remote PTT line is high resulting in the analogue switches IC1A & D being closed. This allows the receive audio output from the transceiver (Rx DEMOD) J2/12 to be fed via the closed analogue switch IC1A to the Rx input of the remote control P2/17. To prevent the Tx audio output from the 9300 from loading down the receiver audio line, the receiver audio line analogue switch IC1B is open. This is achieved by its control pin 5 being held low by the closed IC1D.

When the 9300 initiates a PTT command, data is sent to the remote control interface via the transceiver's RS232 input and I^2C bus to set the remote PTT line P2/2 on the remote control interface low.

This opens analogue switches IC1 A & D disconnecting the receiver audio and closing IC1B, connects when the FSK audio output (Tx AUDIO) from the 9300 to the remote control interface.

RS232/I^2C Interface

(15–00752)

General description

The RS232/I^2C Interface unit is used to provide two additional serial ports for transceivers 9323 and 9360 or Remote Control Console 8570. The unit would normally be located at the transceiver end of the 'option R' cable. It can be located next to an extended control head but requires a special cable between the interface unit and the control head.

Serial port 1 must be used as a computer interface and serial port 2 for a GPS receiver. The maximum of two RS232/I^2C Interface units may be connected to the transceiver or remote control console.

Setup

Before using the RS232/I^2C Interface unit it is necessary to configure each port for the GPS and computer. This is achieved by setting the DIP switches located within the box, as applicable.

To gain access to the DIP switches located on the PCB, it is necessary to remove the single screw securing the back cover (identified by the silk screened title RS232/I^2C Interface), then remove the cover.

Each RS232 port may be configured with a number of baud rates using DIP switches as shown in the Tables 5–1 to 5–4 below.

Table 5–1: DIP switch positions for baud rate (GPS)

S1 DIP 5 switch	S1 DIP 4 switch	Setting
on	on	9600 baud, no parity, 1 stop
on	off	4800 baud, no parity, 1 stop
off	on	2400 baud, no parity, 1 stop
off	off	1200 baud, no parity, 1 stop

Table 5–2: DIP switch positions for baud rate (computer)

S1 DIP 7 switch	S1 Dip 6 switch	Setting
on	on	9600 baud, no parity, 1 stop
on	off	4800 baud, no parity, 1 stop
off	on	2400 baud, no parity, 1 stop
off	off	1200 baud, no parity, 1 stop

Enabling Ports

Table 5–3: DIP switch positions for GPS

S1 DIP 1 switch	GPS
off	enabled
on	disabled

Table 5–4: DIP switch positions for computer

S1 DIP 2 switch	Computer
off	enabled
on	disabled

Disabling unused ports will reduce data processing time.

RS232/I^{2}C Interface address

If you have two RS232/I^{2}C Interface units connected to one transceiver or control console then each unit must be set to a different address. To do this you set S1 DIP 3 switch as detailed in Table 5–5 below.

Table 5–5: DIP switch positions for RS232/I^{2}C Interface address

S1 DIP 3 switch	RS232/I^{2}C
off	First unit
on	Second unit

Either RS232/I^{2}C Interface can be identified as the first unit.

Technical description

(04–03086)

The RS232/I^{2}C Serial Interface unit is used to interface the transceiver 9323 or 9360 and the Remote Control Console 8570 via the I^{2}C bus of the ‘option R’ connector. The 87C654 microprocessor IC2 controls the I^{2}C bus protocols and data exchanges to the transceiver or control console. The I^{2}C line levels are driven by IC5. LC filters on the I^{2}C minimise microprocessor noise into the transceiver.

Each serial port is driven by the same microprocessor with RS232 line level conversion using a MAX231 driver, IC4. Signal levels on the microprocessor side of IC4 are TTL compatible, while signals on the line side are at true RS232 levels.

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6 Maintenance

General

CMOS devices

A number of Complementary Metal Oxide Semiconductor (CMOS) devices are used in the remote control equipment. Although protection is built into most of these, their extremely high open–circuit impedance makes them susceptible to damage from static charges. Care must therefore be used when shipping and handling the devices and in servicing equipment in which they are installed.

Packaging

Replacement CMOS devices are supplied in special conductive packaging. They should be left in this packaging until required for use.

Switch off

Ensure that supplies are switched off before disconnecting or reconnecting any connections between circuit boards and the remainder of the remote control equipment.

Handling

Handling of circuit boards and particularly touching any conductive parts should be kept to a minimum.

Grounding

Anything connected to or touching the circuit board tracks should be grounded as follows:

- Test equipment connected to a board should be grounded via its mains lead.
- Static charges that may build up on the person can be discharged by touching a grounded metal surface with both hands. This should be done before, and at frequent intervals while working on circuit boards.
- Wearing a suitably grounded conductive wrist strap will minimise the static build–up on the person.

Circuit boards

Excessive heat

Excessive heat may lift the track from circuit boards, causing serious damage. Avoid the use of high–powered soldering irons: a 60 W maximum iron, preferably temperature controlled at approximately 370°C, is sufficient for most tasks. A slightly higher temperature (425°C) iron may be required for heavier components such as PA transistors. Apply the iron only long enough to unsolder an existing joint or to solder a new one.

Unsoldering

When unsoldering use a solder–sucker or Solderwick to remove solder.

Do not use sharp metal tools such as screwdrivers or twist drills, as these will damage the printed circuit track.

Component substitution

Avoid unnecessary component substitution as this may damage the component, the circuit track or adjacent components.

Component replacement

A component may be replace when it is diagnosed as defective, or the fault cannot be diagnosed in any other way than by substitution. Observe the following when installing replacement components:

- Axial leads—Components with axial leads, e.g. resistors and tubular capacitors, can often be replaced without unsoldering the joints on the boards. The defective component can be removed by clipping its leads close to the component, leaving the leads soldered to the board. These leads should be straightened so that the leads of the replacement can be wrapped around them and soldered. After soldering the excess lead should be clipped off.
- Remove solder—When a component has been unsoldered from the board, ensure the holes are clear of solder before inserting the leads of the replacement.

Never force the leads through the holes as this will damage the circuit track, particularly where plated–through holes are used.

- Observe orientation—Before replacing diodes, transistors, electrolytic capacitors or integrated circuits, observe any markings indicating polarity or orientation. It is essential that these types of components are installed with the correct connections. If necessary, consult the manufacturer’s data for indications of the polarity of diodes, capacitors and transistors.

- Heatsinking—Whenever possible use long–nosed pliers or some other form of heatsinking on the leads of heat sensitive components when soldering them to the board.
- Thermal conduction—When replacing transistors that are mounted on heatsinks ensure good thermal conduction between the heatsink and the replacement by cleaning the mounting surfaces and recoating them with a thermal conduction compound such as Jermyn Thermaflow A30.

Track repair

Broken or burnt sections of printed circuit track can be repaired by bridging the damaged section with tinned copper wire. The section where the repair is to be made must be cleaned observing the precautions before soldering (see page 6–2, *Unsoldering*).

Dismantling and reassembling

8570 Remote Control Console

To gain access to the boards, place the front panel face down on a protective material (to prevent scratching the panel) and remove the four screws located under the front and rear back flanges of the front panel. While holding the front panel to the housing, turn the whole assembly over, then lift up the front panel and lay face down in front of the housing. Access to all the PCBs is now possible.

To reassemble, reverse the procedure detailed above. To disconnect the keypad from the Microprocessor & Display PCB (P1 and P2), apply pressure to the small latches located at each end of the connector and lift to release the ribbon cable. To reassemble, reverse the procedure.

All PCBs are removed by disconnecting the plug–in cables and then removing the retaining screws. To reconnect, reverse the procedure taking care to ensure the cable connectors are correctly orientated with their appropriate partner.

8571 Remote Control Interface

To gain access to the boards to carry out measurements, the top cover should be removed from the interface unit. To remove the cover, the two screws (one on each side) must be removed and the rear edge of the cover lifted and drawn back so the front edge is released from the front panel surround.

To remove the PCBs it is necessary to remove the front panel. This is achieved by removing the two countersunk screws located each side of the front panel, then pulling the panel forward to release from the casing. The PCBs can now be removed by carefully pulling the boards forward and sliding out of their runners. Take care when refitting the PCBs to ensure the connectors are correctly aligned before pressing the PCB fully home.

To reassemble the front panel and the top cover reverse the procedures detailed above.

Fault diagnosis

General

The removal and substitution of components may damage the components and/or the printed circuit boards. In some cases it is impossible to remove components without destroying them. It is important therefore to carry out as much diagnosis as possible with components in situ. Specific tests are described later in this section. The general points which follow should also be of assistance.

Spare boards

If spare boards are held in stock, they may be substituted in order to positively localise the fault to one board.

Transistor tests (static)

Transistor failures are most often due to open–circuit base–emitter or base–collector junctions, or a short circuit between emitter and collector.

These types of faults can often be detected without removing the transistor, using the Ω range of a multimeter. The two junctions should both give the appearance of a diode, i.e. high resistance with the multimeter leads one way round and low resistance when the leads are reversed (polarity depends on whether a PNP or NPN transistor is being tested). Resistance between collector and emitter should be high with the multimeter leads either way round. The circuit diagram should be examined for parallel paths before a transistor failing these test is removed.

Transistor tests (dynamic)

Some transistor faults can be diagnosed by measuring voltages within the circuit. One of the most significant voltage measurements is the base–emitter voltage. The polarity of this will depend on the type of the transistor (PNP or NPN). A base–emitter voltage between 0.5 and 0.9 V should be measured on a forward–biased base–emitter junction.

With its base–emitter junction forward biased, the transistor should conduct. Some indication of satisfactory operation of the transistor can be obtained by measuring the voltage drop across its collector or emitter resistor and short circuiting its base to the emitter. The short circuit will remove the forward bias, cutting off the transistor so that the voltage across the resistor will be considerably reduced.

Integrated circuits

If there appears to be no output from an integrated circuit, before replacing the device, it should be ascertained whether the fault is due to the IC or its load. As a general rule, if changes in input cause absolutely no changes in the corresponding output, the IC should be suspected. If, however, even a very small change in output can be detected the load is more likely to be the cause. Depending upon the circuit, further tests should be made by disconnecting resistors, capacitors etc to verify this diagnosis before removing the IC.

Voltage measurements

The circuit diagrams and the relevant circuit notes give voltages at various points under the various conditions. This aids in locating the faulty section of the remote control equipment.

The parameters listed below should always be checked first.

Table 6–1: Supply voltages on 8570 Audio Processor & PSU PCB

(08–03977)

Supply	Description	Voltage	Source
A	unregulated DC supply	13.5 V nominal	T2/D4/D5 Transformer/rectifier
B	+10 V regulated supply	10 V ±0.2 V	IC14
+5	+5 V regulated supply	5 V ±0.4 V	IC15
+5 V bias 1	+5 V analog reference	5 V ±0.5 V	R111/R112
+5 V bias 2	+5 V analog reference	5 V ±0.5 V	R109/R110

Table 6–2: Supply voltage on 8570 Microprocessor & Display PCB

(08–03978)

Supply	Description	Voltage	Source
5 V ref	+5 reference for AD conversions	5 V ±0.2 V	junction R35 & V7 to gnd

Table 6–3: Supply voltages on 8571 Backplane PCB

(08–03994)

Supply	Description	Voltage	Source
A rail	unregulated DC supply	14 V nominal	external transceiver in 12 V systems
+5 rail	+5 V regulated supply	5 V ±0.4 V	IC1

Table 6–4: Supply voltages on 8571 Microprocessor & Tcvr Interface PCB

(08–03993)

Supply	Description	Voltage	Source
B rail	+10 V regulated supply	10 V ±0.2 V	IC10
+5 V	+5 V bias supply	5 V ±0.5 V	junction R44/R45
2.5 V	+2.5 V bias supply	2.5 V ±0.25 V	junction R34/R35
5 V ref	+5 V reference for ADCs	5 V ±0.2 V	V5/R42

Table 6–5: Supply voltages on 8571 Dual Line Equaliser PCB

(08–03905)

Supply	Description	Voltage	Source
B rail	+10 V regulated supply	10 V ±0.2 V	IC6
+6 V bias	+6 V reference	6 V ±0.6 V	junction R2/R3
+5 V bias	+5 V reference	5 V ±0.5 V	junction R3/R4
+4 V bias	+4 V reference	4 V ±0.4 V	junction R4/R5

Front panel controls

Lack of response to controls may be due to malfunction of one or more of the sealed membrane switches. These can be tested by disconnecting the connectors P1 and P2 from the Microprocessor & Display PCB and testing between pins of the connectors as shown in Table 6–6. A multimeter set to Ω, applied between each pair in turn, should indicate an open circuit with the corresponding switch not operated and continuity (< 100 Ω) when pressed.

Table 6–6: Front panel controls

Connector J1 J2	Keypad Function	Connector J1 J2	Keypad Function
4 – 8	Intercom	6 – 1	function F2
4 – 7	Function	7 – 8	Clarifier up
4 – 1	Control On/Off	7 – 7	Channel up
5 – 8	Tcvr On/Off	7 – 6	Volume up
5 – 7	Scan	7 – 5	number 7
5 – 6	S'call Mute	7 – 4	number 8
5 – 5	number 1	7 – 3	number 9
5 – 4	number 2	7 – 2	Review up
5 – 3	number 3	7 – 1	function F3
5 – 2	Call	8 – 8	Clarifier down
5 – 1	function F1	8 – 7	Channel down
6 – 8	Tune	8 – 6	Volume down
6 – 7	USB LSB	8 – 5	Recall
6 – 6	Mute On/Off	8 – 4	number 0
6 – 5	number 4	8 – 3	Enter
6 – 4	number 5	8 – 2	Review down
6 – 3	number 6	8 – 1	function F4
6 – 2	Delete		

Logic levels

If the switches on the keypad are found to be satisfactory, then lack of response may be caused by faults in the microprocessor network.

With the aid of an oscilloscope, check for 5 V pulses at the five outputs of input/output expander IC2 pins 10, 11, 12, 13, and 17 (Microprocessor & Display PCB). If satisfactory, check that these pulses appear on the output of the switch membrane where it is applied to IC2 pins 18 to 25 with the appropriate keypad switch pressed (refer to Table 6–6 for connections).

If the tests above appear correct, then continue pressing the switches on the keypad, and check for 5 V pulses on the Data bus (it may be necessary to press a number of switches to check all data lines). Check also on IC2 that the READ line (RD pin 5) is low, and the WRITE line (pin 36) is high (5 V approx). No data or level change should be investigated further.

No reception!—with signalling

The following fault finding procedure is based on a remote control system consisting of a single 8570 Console, a single 8571 Interface, and transceiver. In the case of multiple systems, consideration must be given to the other units within the network when tracing a “No reception!” fault.

If there is no reception but the commands from the keypad are functioning, then the 2 or 4–wire link between the 8570/8571 and the shared receive and signal path in both units are unlikely to be at fault. Therefore check the remaining sections of receive path in the 8570, 8571, and transceiver as follows.

8570 Console

- ❑ Check all regulated DC supplies (see page 6–6, *Voltage measurements*).
- ❑ Disconnect the 2 or 4–wire link from the console.
- ❑ Apply a 1 kHz tone at a level of 100 mV P–P to the line input pins 2 & 5 for 2–wire or 200 mV P–P to pins 1 & 2 for 4–wire on the line interface assemblies.
- ❑ Check for 1 kHz tone in the speaker. If clearly heard (reduce volume control setting if overloading), the console is probably not at fault. Reconnect the console to the line and initiate the automatic equalisation sequence. Continue from page 6–10, *8571 Interface*.
- ❑ If no sound is heard in the speaker, select Setup mode (see *Chapter 3, Using the system,* in the *8570 and 8571 Remote control operators handbook*) and select Function 20.
- ❑ Press Enter and Recall together to select the line parameters to Default settings.
- ❑ Switch off and then on again to exit Setup mode.
- ❑ With the 1 kHz connected as detailed above, use an oscilloscope to trace the 1 kHz signal on the Audio Processor & PSU PCB 08–03977 through the receive path not shared with the FSK signalling.

  Commence at TP2 (output of the 3 kHz LPF IC7d) and check for the presence of the 1 kHz tone. Then continue checking the outputs of the 300 Hz notch filter IC11 (TP3), mixer IC1c (TP4), gain controlled amplifier IC2b (TP5), and finally the output of the power amplifier IC8 (TP6). Refer to Audio Processor & PSU circuit diagram 04–02585 for levels. If there is a signal at TP6, check speaker for open circuit speech coil.

The audio levels after the gain control amplifier IC2b will depend on the setting of the volume control. If set too high, it will result in clipping of the audio at the output of the audio amplifier IC8.

8571 Interface

- ❑ Before checking the receive path in the Interface unit, ensure the 8570 is connected to the line and equalised.
- ❑ Remove the Transceiver Interface cable at the 8571 end. Apply a 1 kHz tone at a level of 1.2 V P–P to the input of transformer T1 on the Microprocessor & Tcvr Interface PCB (Connector P1 pins 14a & 16a).
- ❑ Using an oscilloscope, check if the 1 kHz signal is present at the output of the line driver IC102 on the Dual Line Equaliser PCB 08–03904 (pin 5), and that it measures approximately 800 mV P–P.

  If the 1 kHz signal is present, then the 8571 Interface unit is probably operating. Check for possible faults in the transceiver and the interface cable.

  If there is no audio at IC102, then the 1 kHz signal should be traced through the receive path on the Microprocessor & Tcvr Interface PCB (08–03993).
- ❑ Commence by checking the 1 kHz level at the secondary of the input transformer T1. If correct, continue checking the receive path through switch ‘C’ IC2c, then at the output of the 300 Hz notch filter IC4, through the switch ‘A’ IC2a, then the output of Audio Compressor IC7, and finally at the Rx Audio Bus (via the Modem IC6). Refer to circuit diagram 04–02690 for levels. From here the remaining receive path is shared with the signalling path and therefore is unlikely to be faulty.

  If the signal is absent at any of the test points, examination of the neighbouring circuits should assist in locating the fault.

Transceiver

If the interface cable is not at fault, then the transceiver should be checked. This can be done by referring to the appropriate Technical Service Manual for the transceiver.

No reception!—no signalling

The following fault finding procedure is based on a remote control system consisting of a single 8570 Console, a single 8571 Interface, and transceiver. In the case of multiple systems, consideration must be given to the other units within the network when tracing a “No reception!” fault.

If there is no reception and no commands functioning from the keypad, such as channel changing, then the fault may be in an area shared by the receive and signal path. Alternatively this may be the result of two separate faults, no receive, and no signalling. If a signalling fault still exists after repairing the receive fault, continue to check for a signalling fault (see page 6–11, *No signalling!*).

To assist in locating a receive fault, check the 2 or 4–wire link, the 8570 Console, the 8571 Interface, and the transceiver as follows.

Line

❑ Check the 2 or 4–wire link using an audio amplifier with a speaker or an oscilloscope for receive noise.

If there is no receive noise on the line and the 8571 Interface proves to be operational, check the line by applying a known level of 1 kHz tone (say 0 dBm) from a 600 Ω source at one end and measuring the level at the other end when terminated into 600 Ω. Check the attenuation meets specification. Check in both directions for a 4–wire system.

8570 Console

If receive noise can be heard on the line, check the 8570 Console by applying the setup procedure, (see page 6–9, *8570 Console*). With an oscilloscope, check the 1 kHz audio through the shared receive/FSK signalling path on the Audio Processor & PSU PCB (08–03977).

Check for the presence of the 1 kHz tone at the 2 or 4–wire interface, the outputs of amplifier IC4a, the gain controlled amplifier IC10a, the audio equalisation amplifiers IC10b and IC6b, and finally the output of the 3 kHz LPF IC7d. Refer to circuit diagram 04–02585 for levels.

If the signal is still present at the output of IC7d (3 kHz LPF), then there is a possibility of more than one fault in the system (signalling and a receive fault). Continue tracing the 1 kHz signal (see page 6–9, *8570 Console*).

8571 Interface

- Check the DC input supply and the regulated supplies are correct for the 8571 (see page 6–6, *Voltage measurements*).
- Check the 8571 Interface by carrying out test setup detailed above.

Transceiver

If the interface cable is proved to be satisfactory, then the transceiver should be checked. This can be done by referring to the appropriate Technical Service Manual for the transceiver.

No signalling!

No signalling can be due to a loss of one of the regulated supplies, a failure in the microprocessor and control circuit, or a problem in the transmit/audio paths.

A study of the technical description of the signalling system should assist in checking for a signalling fault.

If there is a second system available, then swap the units to assist in identifying the faulty unit. However, if this is not possible, then it is necessary to carry out a number of tests to pinpoint the area in which the signalling has failed.

8570 Console

If the signalling system is operational in the console, then initiating a channel change should result in an error message. Also, using an oscilloscope connected across the line, nominally 700 mV P–P, consisting of the 300 Hz control tone combined with the FSK signal should be seen for a short period after the channel change. If the signalling in the console appears to be working, then a fault could be due to a failure in the line, the 8571 or the transceiver.

If there appears to be no activity when initiating a channel change, check the console:

❑ Check all regulated DC supplies for the 8570 (see page 6–6, *Voltage measurements*).

❑ Select Setup mode (see the *8570 and 8571 Remote control operators handbook*).

❑ Select Function 20 and press Review up or down to check if the display cycles through the line parameters.

❑ If the console functions correctly, continue at *Checking other equipment.*

❑ If the display fails to change, is blank, or the unit fails to switch off when pressing the on/off pad, then continue below.

❑ Check:

- the microprocessor and its associated circuits on the Audio Processor & PSU PCB (08–03977)
- the reset line is low
- the address/data lines for activity when the keypads are pressed (one or more lines may be held low due to a faulty integrated circuit)
- the clock is operating
- the input/output and DAC ICs are working

Checking other equipment

❑ If the microprocessor and its associated circuits appear to be functioning, then check the tone generator, the 103 Bell modem, and the signal path for possible failure.

8571 Interface

If the fault appears to be in the 8571 Interface, then unless the remote site is suitably equipped, it is recommended the equipment be returned to the workshop for the necessary repairs.

A working 8570 Console, a transceiver, a power supply and an oscilloscope are required to assist in fault diagnosing the 8571 Interface unit.

❑ Place both the 8570 and the 8571 in close proximity (for ease of servicing) and connect together via a 2 or 4–wire line. Incorporate a suitable attenuator to prevent overloading of the signals. Connect a transceiver and power supply to the 8571.

- ❑ While pressing the up or down channel change on the keypad of the 8570, use an oscilloscope and check for 300 Hz control and FSK signals through the 8571 signal path.

  A fault in the 300 Hz control circuits can be traced by applying a 300 Hz signal at a 100 mV P–P from an Audio Signal Generator to the input to the 8571.

- ❑ With an oscilloscope, check for 300 Hz on the Dual Line Equaliser PCB (08–03905), at the outputs of the hybrid IC101a, the 300 Hz BPF IC106 (check the clock frequency is 30 kHz), and the threshold detector amplifier IC104a. The measured level at the output of 300 Hz threshold amplifier IC104a will depend on the DC current applied to the control input pin 1. Set to default mode to check nominal levels shown on the circuit diagram 04–02541.

- ❑ Check the output of the detector IC105b is high (5 V) when the control tone is present. Check also the output of combiner inverter IC5 is low (300 Hz Detect bus). Check the 300 Hz detector to the microprocessor IC12 pin 18, on the Microprocessor & Tcvr Interface PCB, goes high (5 V) while the 300 Hz is present.

  Unless special equipment is available, continuous channel changing from the keypad should be a sufficient signal source to trace the FSK signal through the signal path of the 8571.

- ❑ Commencing on the Dual Line Equaliser PCB (08–03905) with an oscilloscope, check for burst of the FSK signal at the outputs of the hybrid IC101a, the gain control amplifier IC103a, the equalisation amplifiers IC103b and IC104b, and finally the output of the 3 kHz LPF IC105a. Again, levels will depend on the input level to the 8571 and the gain settings of gain controlled amplifier IC103a and equalisation amplifiers IC103b and IC104b.

- ❑ Check the FSK on the Tx audio bus on the Microprocessor & Tcvr Interface PCB (Tx and FSK share the same path at this point). Check that the FSK is applied to the modem input pin 15 of IC6, that data appears at the demodulated output pin 5, and that FSK detect pin 3 goes low during the signal period.

By setting the equalisation to the default setting and input levels as detailed on the circuit diagram 04–02541, the gains and signal levels can be measured. Default setting is carried out by disconnecting the DC power, setting the digiswitch on the Microprocessor & Tcvr Interface PCB to D and reconnecting the DC power. To return to automatic equalisation, repeat the above but select E on the digiswitch.

No transmission!

The following fault finding procedure is based on a remote control system consisting of a single 8570 Console, a single 8571 Interface and transceiver. In the case of multiple systems, consideration must be given to the other units within the network when tracing a “No transmission!” fault.

If transmission is the only fault in the remote control system then the areas to be checked are the transmit audio path in the 8570 Console, the transmit audio path in the 8571, and the transceiver.

8570 Console

Normal PTT function is inhibited in the console unless signalling to and from the transceiver via the 8571 Interface is successful. However, providing signalling is possible between the two units, then by selecting Intercom mode, the 300 Hz control tone can be enabled by operating the PTT at the Console.

If the PTT will operate either in the normal mode or by selecting Intercom, connect an oscilloscope to the line output of the 8570 Console and verify the 300 Hz control tone is present and measures 700 mV P–P approximately.

❑ Talk into the microphone and check if the speech is also seen on the oscilloscope.

If speech is present on the line, then the problem is unlikely to be in the console. If no speech is present then continue to the next paragraph. Continue at page 6–14, *8571 Interface*.

If it is not possible to operate the PTT in the 8570 Console then a possible signalling fault also exists and should be repaired before continuing with the "No transmission!" fault.

❑ Check all regulated supplies for the 8570 (see page 6–6, *Voltage measurements*).

❑ By use of a suitable test box, apply a 1 kHz audio at a level of 50 mV P–P to the local microphone input, and operate the local PTT.

❑ With an oscilloscope, trace the transmit audio path on the Audio Processor & PSU PCB (08–03977).

❑ Check the 1 kHz signal level at the:

- microphone input
- switch IC20b output amplifier IC1d (TP7)
- output of compressor IC2a (TP8)
- mixer IC1a (TP9)
- line driver IC3 (TP10)

Check the circuit diagram 04–02585 for approximate signal levels.

❑ If the signal is absent at any of the test points, examination of the neighbouring circuits should assist in locating the fault.

8571 Interface

❑ Select Transmit mode (PTT) on the 8570 (see the *8570 and 8571 Remote control operators handbook*), and apply a 50 mV P–P 1 kHz audio to the local microphone input. With an oscilloscope, check the line input to the 8571 for a 300 Hz control signal mixed with the 1 kHz transmit audio.

These signals may only measure a few millivolts and will depend on the attenuation of the line.

- ❑ Check that the Transmit mode has been selected in the 8571 by verifying the PTT line is low (pin 11 of microprocessor IC12 on the Microprocessor & Tcvr Interface PCB 08–03993). If not selected, check the 300 Hz threshold detector and associated circuits on the Dual Line Equaliser PCB (08–03905) for possible faults.
- ❑ Check the transmit audio (including the 300 Hz) at the output of the hybrid IC101a on the Dual Line Equaliser PCB (08–03905). Continue to check for audio at outputs of the gain control amplifier IC103a, equalisation amplifiers IC103b, IC104b, and the 3 kHz LPF IC105a.
- ❑ From the output of IC105a, check if the transmit audio is present on the Tx bus (Backplane PCB), then at pins 3 and 4 of switch IC2c on the Microprocessor & Tcvr Interface PCB 08–03993 (selected in Tx mode). Finally check for the 1 kHz tone at the output of the 300 Hz notch filter IC4 and then via IC2a pins 14 and 13 to the Tx audio input transformer T2.
- ❑ If the signal is absent at any of the test points, examination of the neighbouring circuits should assist in locating the fault.

Transceiver

If audio is present at the secondary of transformer T2, then the interface cable and the transceiver should be checked. This can be done by referring to the appropriate Technical Service Manual for the transceiver.

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7 Adjustments

This chapter provides information on:

- programming channels (7–2)
- programming 8525 and 8528 series transceivers (7–3)
- programming 9323 and 9360 series transceivers (7–8)
- adjusting mute (7–13)
- setting the equalisation parameters (7–13)
- calibrating the battery voltmeter (7–14)

Programming channels

Channels can be programmed into the memory of the transceiver by using the controls on the front panel of the 8570 Console. Frequencies for each channel are programmed into an E^2PROM and remain stored until they are reprogrammed or erased.

The two transceiver series 8525/8528 and 9323/9360 can be used with the remote control system and differ slightly in their channel programming.

Programming 8525 and 8528 series transceivers

When using the Transceiver 8528, two types of transmit enabling are available: TxD and TxE. The choice of which one is determined by the program in the EPROM.

TxD

To access Program mode with TxD:

- ❑ Switch off the 8570 Console.
- ❑ Unscrew and remove the front panel.
- ❑ Move the link (see Figure 7–1), to the P Channel Program position.
- ❑ Switch on the console.

  The 8570 is now in the Program mode (no Tx or Rx). The transmit frequencies can be programmed into the P channels.
- ❑ To return to normal mode after programming, switch off the console and return the link to the Idle position.
- ❑ Replace the front panel.
- ❑ Switch on the console.

TxE

To access Program mode with TxE:

- ❑ Switch off the transceiver.
- ❑ Move the link (see Figure 7–1), to the P Channel Program position and switch on.

  The transmit frequencies can now be programmed into the P channels. With this version, the link may remain in the P Channel Program position, and the transceiver will operate normally. Additional transmit frequencies can then be added at any time.

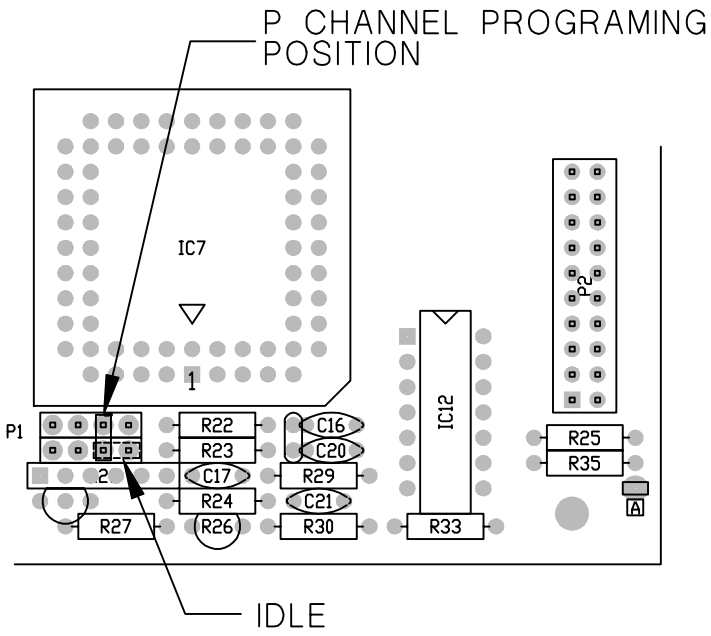

Figure 7–1: 8570 Front Panel Display PCB P channel program position

When the remote control system uses the Transceiver type 8525B, link 3 on the Microprocessor PCB in the transceiver must be fitted to enable the P Channel function.

Creating a transmit and receive channel

To create a transmit and receive channel:

Action	Display will show	Remarks
Select any channel	Chan Tx XX,XXX.X YYY Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx _ _,_ _ _._ YYY Rx ZZ,ZZZ.Z	Next action must be started within 60 seconds
Press number keys for transmit frequency, say 12,345.0 kHz	Entr Tx 12,345.0 YYY Rx _ _,_ _ _._	2 to 24 MHz (23 MHz in H suffix), entered to the nearest 100 Hz
Press Enter	Entr Tx 12,345.0 YYY Rx _ _,_ _ _._	Programs in the transmit frequency
Press Enter again if the receive frequency is the same	Entr Tx 12,345.0 YYY Rx 13,456.0	12,345.0 will show as the Rx frequency
Press number keys if the receive frequency is different	Entr Tx 12,345.0 YYY Rx 13,456.0	250 kHz to 30 MHz entered to the nearest 100 Hz
Press Enter	Entr options YYY SE , LU	Transceiver defaults to SE, LU
Press Call key to select S/T1/T2/T3/T4	Entr options YYY S _, LU	Each press of the Call key selects next signalling option
Press USB/LSB mode key to select U, L, or LU		Each press selects the next sideband (hardware is required for L options)
Press Enter	Entr Tx 12,345.0 P_ _ Rx 13,456.0	
Press number key for channel number	Entr Tx 12,345.0 PNN Rx 13,456.0	Press Enter only for temporary channel
Press Enter	Chan Tx inhibit PNN Rx 12,345.6	If P channel number already used, select another number, then Enter

Copying a channel

To copy a channel:

Action	Display will show	Remarks
Select required channel giving Tx and Rx frequencies	Chan Tx XX,XXX.X YYY Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx _ _,_ _ _. YYY Rx _ _,_ _ _._	Next action must be started within 60 seconds
Press Enter	Entr options YYY SE,LU	Transceiver defaults to USB
Press Call key to select S/T1/T2/T3/T4	Entr options YYY S_,_U	Each press of Call keypad selects next signalling option
Press USB/LSB mode key to select U, L, or LU		Each press selects the next sideband (hardware is required for L options)
Press Enter	Entr Tx XX,XXX.X P_ _ Rx ZZ,ZZZ.Z	
Press number keys for desired P channel, then press Enter	Chan Tx XX,XXX.X PNN Rx ZZ,ZZZ.Z	For temporary channels, press Enter

When using transceiver 8525B/8528 (land), two–frequency simplex channels must use P70 to P99 only.

When using transceiver 8528S (marine), two–frequency simplex channels may use any P channel. Option LU is not available.

Deleting channels

To delete a channel:

Action	Display will show	Remarks
Select channel to be deleted, e.g. P77	Chan Tx XX,XXX.X P77 Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx _ _,_ _ _._ P77 Rx ZZ,ZZZ.Z	Next action must be started within 60 seconds
Press Enter	Entr options P77 S_,_U	
Press Enter	Entr Tx XX,XXX.X P_ _ Rx ZZ,ZZZ.Z	
Press Delete	Chan Tx XX,XXX.X P76 Rx ZZ,ZZZ.Z	Channel before that is deleted

Temporary channels

In any of the programming operations, the Enter key can be pressed instead of entering a channel number. This will create a temporary channel which will not be saved when the channel is changed, or the power is switched off.

Program inhibit indication

If required, established P channels can be protected from being accidentally deleted or overwritten. This is detailed in the *8570 and 8571 Remote control operators handbook* and the *8570 and 8571 Remote control installation handbook*. If an attempt is made to overwrite or delete a channel, the display will show an error message for a few seconds after Enter is pressed. The Tx and Rx parameters chosen can still be accepted by entering a new channel number and pressing Enter again.

Too high, too low indications

If an attempt is made to program a channel with either a Tx or Rx frequency outside the range of the transceiver, an error message will be displayed. The error can be corrected by simply entering a new frequency that is within the range.

Programming 9323 and 9360 series transceivers

When using Transceivers 9323/9360, two types of transmit enabling are available: TxD and TxE. The choice of which one is determined by the program in the EPROM.

TxD

To access Program mode with TxD:

- ❑ Switch off the 8570 Console.
- ❑ Unscrew and remove the front panel.
- ❑ Move the link (see Figure 7–2) to the Channel Program position.
- ❑ Switch on the console.

  The 8570 is now in the program mode (no Tx or Rx). The transmit frequencies can now be programmed to a maximum of 400 channels (see note below) using channel numbers 1 to 9999.

- ❑ To return to normal mode, after programming, switch off the console and return the link to the Idle position.
- ❑ Replace the front panel.
- ❑ Switch on the console.

TxE

To access Program mode with TxE:

- ❑ Switch off the transceiver.
- ❑ Move the link (as shown in Figure 7–2) to the Channel Program position.
- ❑ Switch on the console.

  The transmit frequencies can now be programmed to a maximum of 400 channels (see note below) using channel numbers 1 to 9999. With this version, the link may remain in the Channel Program position, and the transceiver will operate normally. Additional transmit frequencies can then be added at any time.

The total number of channels that can be programmed will depend on the amount of channel text used on existing channels that have been programmed direct to the transceiver, not via the 8570 console.

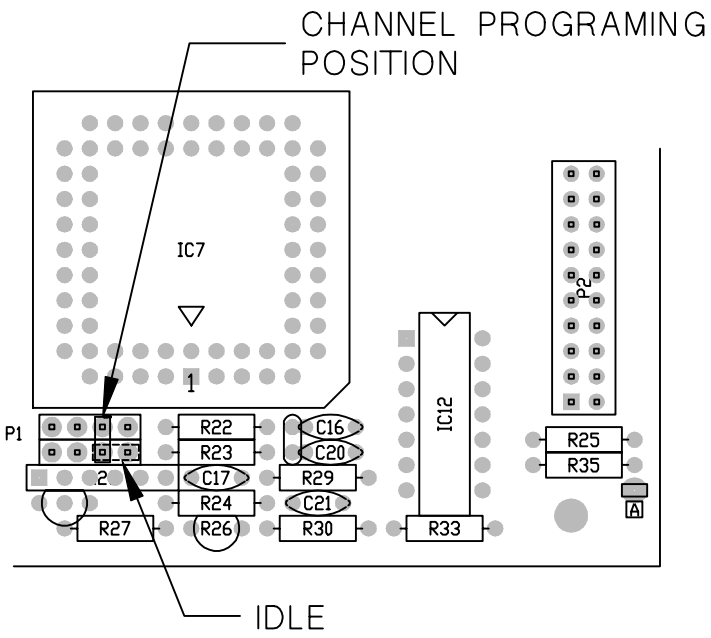

Figure 7–2: 8570 Front Panel Display PCB channel program position

Creating a transmit and receive channel

To create a transmit and receive channel:

Action	Display will show	Remarks
Select any channel	Chan Tx XX,XXX.X YYY Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx _ _,_ _ _._ YYY Rx ZZ,ZZZ.Z	Next action must be started within 60 seconds
Press number keys for transmit frequency, say 12,345.0 kHz	Entr Tx 12,345.0 YYY Rx _ _,_ _ _._	2 to 26.5 MHz, entered to the nearest 100 Hz
Press Enter	Entr Tx 12,345.0 YYY Rx _ _,_ _ _._	Programs in the transmit frequency
Press Enter again if the receive frequency is the same	Entr Tx 12,345.0 YYY Rx 12,345.0	12,345.0 will show as the Rx frequency
Press number buttons if the receive frequency is different	Entr Tx 12,345.0 YYY Rx 13,456.0	250 kHz to 30 MHz, entered to the nearest 100 Hz
Press Enter	Entr Option tone YYY _ _,S,_LU,P	
Press Channel key to select T1/T2/T3/T4	Entr Option tone YYY T1, S, LU,P	Each press of the Channel key selects the next tone calling option, e.g. T1
Press Review key to select Selcall call	Entr Option slcl YYYY T1, _ , LU,P	Each press of the Channel key toggles the selcall on or off, i.e. S or _
Press Review key to select sideband	Entr Option band YYYY T1, S, _U,P	Each press of the Channel key toggles between U, L and LU
Press Review key to select Protection	Entr Option prot YYYY T1, S, _U,P	Each press of the Channel key toggles between P and NP
Press Enter followed by the selected channel number, e.g. 2356	Entr Tx 12,345.0 2356 Rx 13,456.0	If the channel number is already used, select an another number, then Enter

Copying a channel

To copy a channel:

Action	Display will show	Remarks
Select required channel giving Tx and Rx frequencies	Chan Tx XX,XXX.X YYYY Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx _ _,_ _ _._ YYYY Rx ZZ,ZZZ.Z	The next action must be started within 60 seconds
Press the Channel key to select T1/T2/T3/T4	Entr Option tone YYYY _ _,S, _U,P	Each press of the Channel key selects the next tone calling option, e.g. T1
Press Review key to select Selcall	Entr Option slcl YYYY T1, _ , LU,P	Each press of the Channel key toggles the selcall on or off, i.e. S or _
Press Review key to select	Entr Option band YYYY T1, S, _U,P	Each press of the Channel key toggles between U, L and LU
Press Review key to select	Entr Option prot YYYY T1, S, _U,P	Each press of the Channel key toggles between P and NP
Press Enter followed by the selected channel number	Entr Tx XX,XXX.X _ _ _ _ Rx ZZ,ZZZ.Z	

Deleting channels

To delete a channel:

Action	Display will show	Remarks
Select channel to be deleted, e.g. 567	Chan Tx XX,XXX.X 567 Rx ZZ,ZZZ.Z	
Press Enter	Entr Tx __,___._ 567 Rx ZZ,ZZZ.Z	The next action must be started within 60 seconds
Press Enter three times when the channel number is flashing	Chan Tx XX,XXX.X 567 Rx ZZ,ZZZ.Z	
Press Delete to delete channel 567	Chan Tx XX,XXX.X 789 Rx ZZ,ZZZ.Z	The next highest channel is displayed

Program inhibit indication

If required, established channels can be protected from being accidentally deleted or overwritten. This is detailed in the *8570 and 8571 Remote control operators handbook* and the *8570 and 8571 Remote control installation handbook*. If an attempt is made to overwrite or delete a channel, the display will show an error message for a few seconds after Enter is pressed. The Tx and Rx parameters chosen can still be accepted by entering a new channel number and pressing Enter again.

Too high, too low indications

If an attempt is made to program a channel with either a Tx or Rx frequency outside the range of the transceiver, an error message will be displayed. The error can be corrected by simply entering a new frequency that is within the range.

Adjusting mute

The only preset potentiometer fitted to the complete system is for adjusting the mute sensitivity. It is located on the Audio Processor & PSU PCB in the 8570 console. It is best adjusted when the complete system is installed and equalised.

To adjust the mute:

- ❑ With the transceiver connected to an antenna, select an unoccupied channel and adjust the volume using the keypad for an audible background noise from the receiver.
- ❑ Press Mute on/off on the keypad to get the Mute indicator LED to light.
- ❑ Commencing with the preset R92 fully counterclockwise, slowly rotate clockwise until the audio mute opens (mute threshold). Then to reduce sensitivity, rotate the potentiometer a quarter of a turn in counterclockwise direction.
- ❑ The mute circuit should now be sensitive enough to detect weak signals without falsely triggering on noise pulses. However, if desired, the sensitivity may be varied from this setting to suit individual requirements.

  All 8570 consoles in the remote control system should be adjusted in the same manner.

Equalisation parameters

For some applications it may be preferable to manually set the equalisation parameters on the 8570 Console.

To set the equalisation parameters:

- ❑ Switch off the console.
- ❑ Select Setup mode by holding down the Function and Control On/Off key together for approximately two seconds. The display will now show the words Setup mode flashing on and off.

SETUP MODE

- ❑ Enter the Line Parameters menu by pressing Function followed by 20, on the numeral keys, within two seconds.

SPECIAL FUNCTION Number 20

- ❑ Press Enter.

LINE PARAMETERS Rx gain: XX

The equalisation provides a treble boost in the receiver path and can be set by entering 0 (minimum boost) to 63 (maximum boost) from the keypad, followed by pressing Enter.

LINE PARAMETERS Rx equ: XX

❑ Press Review ↑.

LINE PARAMETERS Threshold: XX

This parameter set the 300 Hz threshold detector and can be set by entering 0 (minimum sensitivity) to 63 (maximum sensitivity) from the keypad, followed by Enter.

❑ Press the Review ↑ again.

LINE PARAMETERS Termination: on

❑ Press Channel ↑ or ↓ to change the termination on or off, (see *8570 and 8571 Remote control operators handbook*).

❑ Press Review ↑ again.

LINE PARAMETERS Cfg: not split

If this setting needs changing (see *8570 and 8571 Remote control operators handbook*), press Channel ↑ or ↓ to select daisy chain or star split.

The Rx gain amplifier (IC10a) can be adjusted, by entering numbers between 0 (minimum gain) and 63 (maximum gain). Upon entering the desired number, press Enter to store the setting.

When all steps have been completed, the 8570 Console should be switched off to automatically save all the program settings and exit the Setup mode. When the console is turned on again the system will be ready for operation.

Calibrating the battery voltmeter

The battery voltage display can be calibrated as follows:

❑ Remove the four retaining screws to the control panel, and lift forward to gain access to the Audio Processor & PSU PCB (do not disconnect any cables).

❑ Switch on the equipment, and measure the DC voltage at TPA (A rail).

❑ Note the reading.

❑ Switch off the console and replace the control panel.

❑ Select Setup mode (see *Chapter 3, Using the system,* in the *8570 and 8571 Remote control operators handbook*).

❑ Press Function 14.

SPECIAL FUNCTION Number 14

❑ Press Enter.

BACKUP BATTERY adjust <enter> ?

❑ Press Enter.

Measured battery voltage = XX.XV

Compare the displayed voltage reading with the measured voltage taken at TPA. If the displayed reading is different, then the display can be changed by pressing the channel up or down key, until the correct voltage is shown.

❑ Switch off the equipment to store the calibration.

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8 Parts list

General information

The parts lists for each assembly contain the following information:

- a circuit reference number
- descriptions, giving the value and type of component
- a manufacturer and manufacturer’s part number
- a Codan part number

Items having numeric references identifying specific components or subassemblies may be encountered in the parts lists included in this manual. These items, selected from master manufacturing information, identify parts that are either useful for maintenance purposes or relate to other items and may be cross referenced in the remarks column.

Table 8–1: Resistor and capacitor abbreviations

Resistors	**Capacitors**
CC: carbon composition	AS: solid aluminium electrolytic
CF: carbon film	CC: ceramic multilayer chip
MF: metal film	CE: ceramic
MG: metal glaze	EL: wet aluminium electrolytic
MO: metal oxide	M: stacked mica
WW: wire wound	PC: polycarbonate
	PE: polyester
	PP: polypropylene
	PS: polystyrene
	PT: PTFE
	TA: solid tantalum

Ordering information

When ordering replacement components, all of the following information should be quoted to minimise the risk of obtaining the wrong part, and to expedite dispatch.

- equipment type (e.g. Type 7004–A HF Receiver)
- component location (e.g. RF PCB, 08–04685–002)
- component circuit reference number (e.g. R47)
- full component description (e.g. resistor 180 kW 5% 0,33 W CF Res)
- manufacturer and manufacturer’s part number (e.g. Philips CR25)
- Codan part number (e.g. 40–51800–020)

Component substitution

Due to the continuous process of updating equipment and changes in component availability, minor variations in components may be noted from those listed. Equipment performance is in no way adversely affected by their substitution.

When replacing general purpose components (resistors, capacitors etc.), equivalent parts of other manufacturers may be used provided that they have similar tolerances, voltage/power rating and temperature coefficients as those of the specified part.

Parts lists

Table 8–2: Parts list index

Title	Assembly number
8570 Sundry Parts	08–04124–100
Audio Processor & PSU PCB	08–03977
Microprocessor & Display PCB	08–03978
Battery charger PCB	08–05022–001
Battery charger PCB(obsolete)	08–04286
Filter, Remote Control PCB	08–03127
8571 Sundry Parts	08–04127–100
Dual Line Equaliser PCB	08–03905–002
Microprocessor & Tcvr I/F PCB	08–03993
Backplane PCB	08–03994
Option RS+I/O PCB	08–04644–003
Line Isolation Unit PCB	08–03817
4–wire Interface PCB	08–03995–001
Audio Switch	08–05748–001
RS232/I^2C Interface	08–05747–001

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9 Drawings

Table 9–1: List of drawings for the 8570 Console

Title	Drawing	Drawing Number
Audio Processor & PSU	Circuit diagram	04–02585
	PCB Assembly	08–03977
Filter, Remote Control	PCB Assembly	08–03127
Microprocessor & Display	Circuit diagram	04–02586
	PCB Assembly	08–03978
Battery Charger	Circuit diagram	04–03011
	PCB Assembly	08–05022
Battery Charger (obsolete)	Circuit diagram	04–02712
	PCB Assembly	08–04286

Table 9–2: List of drawings for the 8571 Interface

Title	Drawing	Drawing number
Dual Line Equaliser	Circuit diagram	04–02541
	PCB Assembly	08–03905
Microprocessor & Tcvr Interface	Circuit diagram	04–02690
	PCB Assembly	08–03993
Backplane	Circuit diagram	04–02691
	PCB Assembly	08–03994
General Purpose Input/output	Circuit diagram	04–02852
	PCB Assembly	08–04644

Table 9–3: List of drawings for the Line Interface

Title	Drawing	Drawing number
Line Isolating Interface	Circuit diagram	04–02487
Line Isolating Unit	PCB Assembly	08–03817
4 –wire Interface	PCB Assembly	08–03995

Table 9–4: List of drawings for the options

Title	Drawing	Drawing number
Option 2W 8570/8571	Fitting instructions	15–10372–001
Option 4W 8570/8571	Fitting instructions	15–10373–001
Option M 8570	Fitting instructions	15–10374–001
Option PH 8570	Fitting instructions	15–10375–001
Option PM 8570	Fitting instructions	15–10376–001
Option R 8570	Fitting instructions	15–10377–001
Option RS 8570	Fitting instructions	15–10378–001
Option SB 8570	Fitting instructions	15–10379–001
Option FS 8570	Fitting instructions	15–10382–001

Table 9–5: List of drawings for the accessories

Title	Drawing	Drawing number
ALE Split site switch (15–00751)	Circuit diagram	04–03067
	PCB Assembly	08–05748
RS232/I^2C Interface (15–00752)	Circuit diagram	04–03068
	PCB Assembly	08–05747
	Fitting instructions	15–00752–001

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