

HAWK 2 TECHNICAL MANUAL

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1

Introduction

1.1 General

The Hawk is a state of the art rural telephone link that uses radio technology to connect remote telephone equipment to the international telephone network. It is an ideal solution where copper wires are too expensive or difficult to install.

The Hawk provides a range of options and features including:

- > Digital Signal Processing on the audio channels provides improved reliability and group delay performance,
- > Dual Channel operation allowing two telephones to operate independently,
- > Ability to access the remote terminal for diagnostic and system parameter functions, giving total flexibility to system set up and maintenance and reducing visits to the customer site,
- > A wide choice of VHF and UHF frequency bands,
- > Synthesised transmitter and receiver modules allow easy frequency selection,
- > The ability to interface with a variety of Exchanges and telephones using pulse or DTMF signalling,
- > Supports most equipment normally connected to telephone lines, including fax and payphones,
- > Speech privacy on the radio channel, prevents conversations being overheard by casual listener,
- > Designed to operate in a wide range of harsh environments.

1.2 System Overview

The Hawk system is usually delivered as a pair of terminals. One terminal (to be designated as the “Exchange Terminal”) is usually configured for connection to the PSTN while the other terminal (to be designated as the “Customer Terminal”) is usually configured for connection to standard telephone equipment.

Although each terminal may be physically identical, they have different electrical functions that are determined by internal links (refer to Section 4.7).

As shown in Figure 1.1, the Hawk link allows both the Customers telephone and the Exchange to operate as if they were physically connected by standard copper cable, rather than by a radio link.

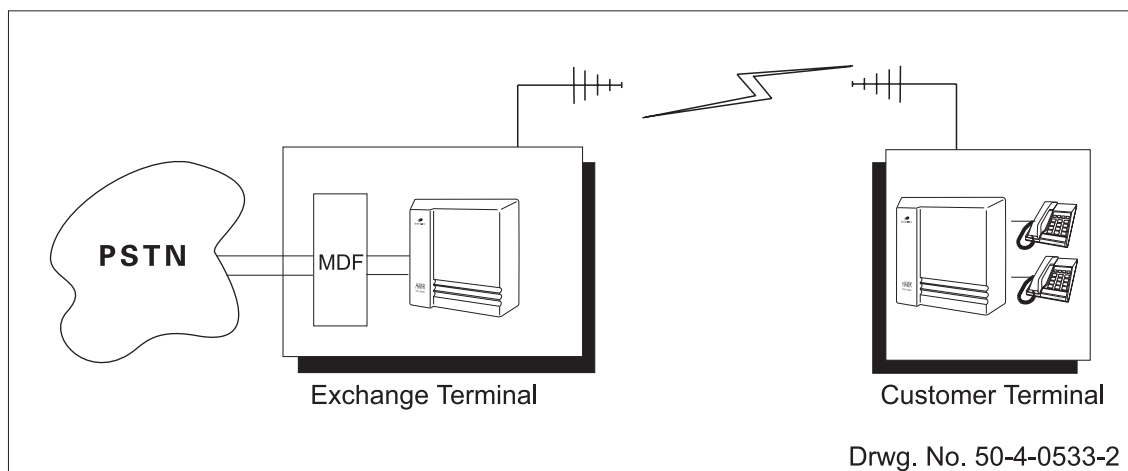


Figure 1.1: Operation of the Hawk Link

1.3 Internal Set-up

The equipment would normally have been pre-configured with the required internal set-up prior to delivery:

- > The transmitter and receiver modules would have been pre-aligned onto the correct frequencies. (Note that the Duplexer modules are pre-aligned to the centre frequencies of the desired operating band – Refer to Appendix A for further details)
- > The Controller module (Type 8080) and the Line Interface modules (Exchange Type 8087, Subscriber Type 8088) are normally configured for either Telephone or Point to Point operation on Channel A or Channel B as desired.
- > If the Hawk is set up for payphone operation, each terminal would also have been configured to operate with the payphone operating system as required.

If required, the configuration of the Controller and Line Interface modules can be checked prior to installation (refer to Section 4).

1.3.1 Labelling¹ of configuration

Details including terminal type, transmit and receive frequencies, transmitter power, equipment site, and power supply voltage are recorded on a label attached underneath each terminal.

RF Frequency

Each Transmitter and Receiver module will also be labelled with the applicable operating frequency.

A full listing of the relevant operating frequency v Hex Code settings for the appropriate operating band plan is provided underneath the wall mount cover. (Refer to Appendix A for details)

Receiver RSSI

A label showing an RSSI (Received Signal Strength Indicator) graph is attached to the bottom of the wall mount cover, adjacent to the Duplexer connector. This graph relates directly to the specific Receiver module within the Terminal, identified by the relevant serial number.

Note: A copy of the same graph is also attached to the Receiver Module shroud and can be seen once the wall mount cover is removed

1.4 Physical Overview

Each terminal has a set of completely self-contained modules, which may be easily removed for adjustment or replacement. The following are the standard modules for all Hawk links to be supplied to Telstra:

- > Type 8080 Controller,
- > Type 8087 Exchange or Type 8088 Subscriber Line Interface
- > Type 2951 VHF Transmitter, or Type 2950 UHF Transmitter,
- > Type 2949 VHF Receiver, or Type 2940 UHF Receiver,
- > Type 2824 Duplexer.

Figures 1.2a and 1.2b show the front and rear view of the Hawk Wall Mount terminal, followed by a list detailing the functions and descriptions of designated items on the figure.

Note: In addition to the standard modules, there are various optional modules that can be used with the Hawk. These are described in the relevant sections.

¹ Note that if Terminals are set to the DEFAULT frequencies prior to despatch, the chassis and module labels will be left **blank** to allow the actual frequencies to be written after installation.

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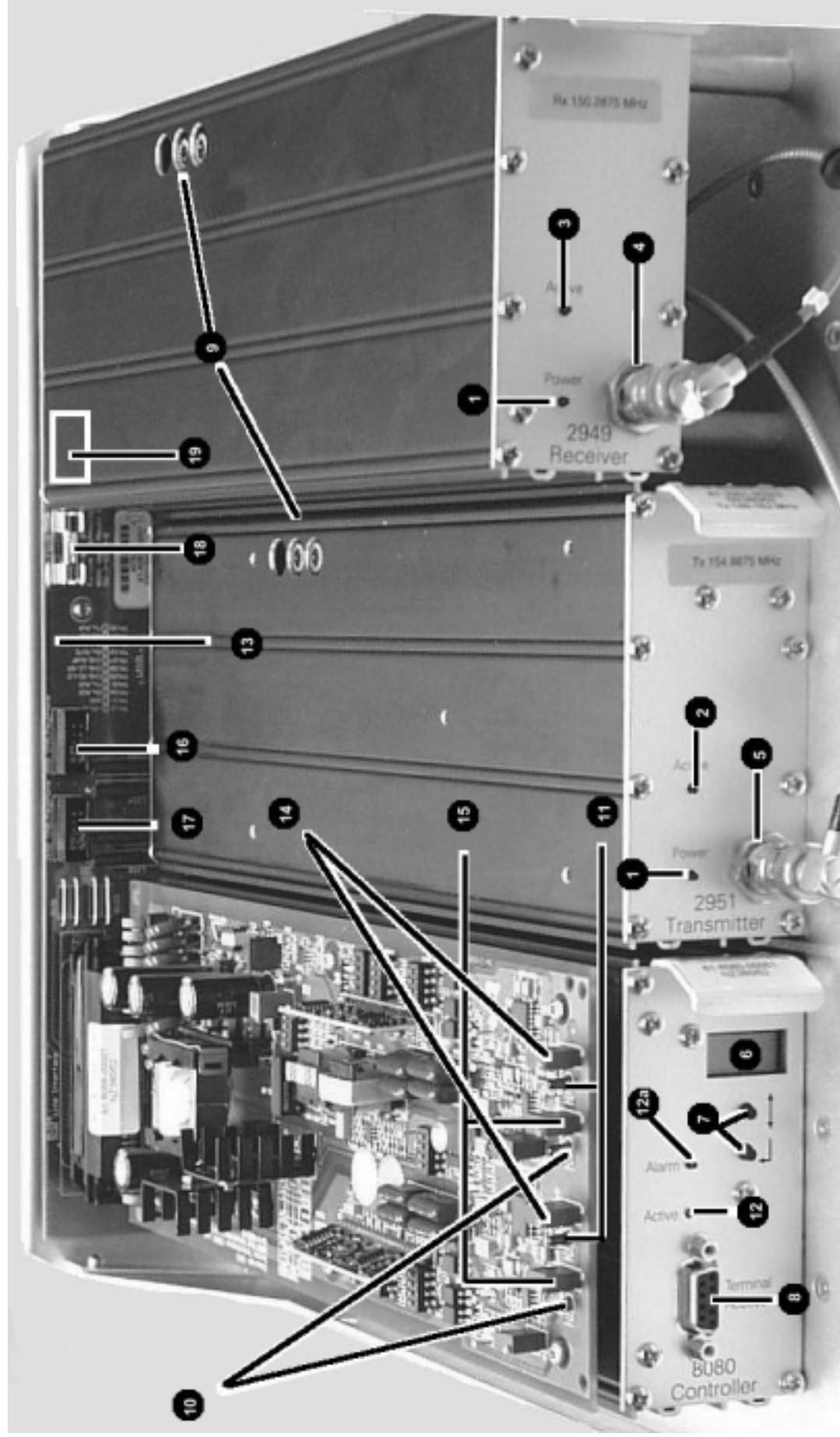


Figure 1.2a: Hawk Wall Mount Terminal - Top View

Key	Description	Function
1	Power LED	Lit when power is supplied to the Tx and Rx module. Should be lit whenever external power is present.
2	Transmitter active LED	Lit when the transmitter is sending a signal over the link.
3	Receiver active LED	Lit when the receiver has detected a valid signal on the link.
4	Receiver input connector	Provides the RF input connection to the receiver. It is connected to the terminal antenna connector (10) via the duplexer (11).
5	Transmitter output connector	Provides the RF output connection for the transmitter. It is connected to the terminal antenna connector (10) via the duplexer (11).
6	Liquid Crystal Display (LCD)	Displays controller functions and meter readings selected by the front panel buttons (7). Refer to Section 2.4 for details.
7	Front panel buttons	Used in combination with the LCD (6) to select controller functions and meter readings. Refer to Section 2.4 for details.
8	RS232C connector	Used to connect the controller to a standard ASCII terminal or a modem. Refer to Section 2.4 for details. Note that as the RS232 information is also accessible via RJ45 socket SK106 (refer Item 25 in Figure 1.2b) connection to Item 8 is not strictly required.
9	Frequency selection switches	Used to select the transmitter and receiver frequencies. Refer to Section 4.11 for details.
10	Ch A/B E-wire LEDs	Lit when the E-wire from the terminal is active on the applicable Channel. Refer to Section 2 for details.
11	Ch A/B M-wire LEDs	Lit when the M-wire to the terminal is active on the applicable Channel. Refer to Section 2 for details.
12	Controller Active LED	Lit when Controller is activated, i.e via front panel button press, PC interrogation (via SK106) etc or during normal Link operation
12a	Controller Alarm LED	Lit if the Link Fail Alarm Relay (RL101) is activated during the Link Check procedure. Refer Section 2.2.9 for details.

Key	Function	Description
13	Motherboard	Provides the connections between the modules and the external connectors on the Hawk.
14	Send audio level adjust	Controls the audio line level to the DSP from the equipment connected to the Hawk.
15	Receive audio level	Controls audio line level from the DSP to the equipment connected to the Hawk.
16	Channel A payphone plug	Provides the Channel A connection for the Type 8075 Payphone module (not shown)
17	Channel B payphone plug	Provides the Channel B connection for the Type 8075 Payphone module (not shown)
18	Fuse	Protects the Hawk from DC power supply overload.
19	Diode (obscured)	Protects the Hawk from reverse transients
20	Channel B 2-wire socket (SK101)	Connector for 2-wire line to Channel B.
21	Channel B 4-wire + E and M socket (SK102)	Connector for 4-wire + E and M line to Channel B.
22	Channel A 4-wire + E and M socket (SK104)	Connector for 4-wire + E and M line to Channel A.
23	Channel A 2-wire socket (SK103)	Connector for 2-wire line to Channel A.
24	Link Fail Alarm Port (SK105)	Connector provided for the Telstra alarm monitoring system
25	RS232 Port (SK106)	Connector provided for connection to the Telstra datagate, PC or Modem
26	DC Power Supply socket (PL105)	Connector for the 13.8 VDC power supply to the Hawk.
27	Antenna Connector	Connector for the coaxial cable to the antenna.
28	Earth Tab	Earth connection for the Hawk terminal.

1.5 System Specifications

1.5.1 Mechanical and Environmental

Size	Wall mount: 390 mm X 380 mm X 125 mm
Weight	Wall mount 7 kg per terminal (approx)
Operating Temperature Range	-30 °C to +55 °C, up to 95% relative humidity, non-condensing

1.5.2 Radio Frequency Performance

Frequency Bands (MHz) Module No.: VHF: Rx 2949 Tx 2951 UHF: Rx 2940 Tx 2950	(Bold RF bands only to be supplied to Telstra) 138-148, 148-162 , 159-174 403-423 , 410-430, 430-450, 450-470 , 470-490, 480-500, 490-512
Transmit Power (at Duplexer Output)	1 W to 10 W (adjustable) Default setting is 1.0 Watt
RF Power Regulation With Supply Voltage With Temperature	±1 dB for 10.6 VDC to 15.5 VDC ±1 dB for -30 °C to +55 °C below 470 MHz
Channel Spacing	25 kHz
Class of Emission	16K8F9WWF
Maximum/Nominal System Deviation	Maximum: 5.0 kHz. Nominal: 3.0 kHz
Transmitter/Receiver Frequency Separation	148-162: 4.5 to 10.0 MHz (default = 4.60 MHz) 403-423: 5.0 to 10.0 MHz (default = 9.45 MHz) 450-470: 5.0 to 10.0 MHz (default = 9.50 MHz)
Co-sited Nest Bandwidth¹	± 200 kHz

¹ Allowable spread of transmitter frequencies for adequate receiver protection in co-sited equipment.

1.5.3 Power Supply Specification

Voltage (measured at the power supply plug on the Hawk terminal)	10.8-15.5 VDC, 13.8 V nominal, negative ground
Noise Specification	<4 mV _{rms} Psophometric <30 mV _{p-p} 5-50 kHz <20 mV _{p-p} above 50 kHz
Maximum DC Supply Current at 13.8 VDC input (per Terminal) (Exchange Terminal)¹	Standby, non-cycling configuration 250 mA
	Standby, cycling configuration 200 mA
	Link established ($\approx$ 10 W Tx output) 3.5 A
Maximum DC Supply Current at 13.8 VDC input (per Terminal) (Customer Terminal)¹	Standby, non-cycling configuration 300 mA
	Standby, cycling configuration 250 mA
	Link established ($\approx$ 10 W Tx output) 3.7 A

1.5.4 General Speech Channel Specification¹

The general speech channel specifications characterise the minimal effect the Hawk link has on the performance of the telephone circuit.

Frequency Response² (at -10 dBr)	Meets CCITT recommendation G.232 Graph B
Noise Performance (at -80 dBm Rx input)	Channel A: 68 dB0p Channel B: 64 dB0p
Unintelligible Crosstalk (measured with 1 kHz 0 dBr in alternative channel at -60 dBm Rx input)	Channel A: 69 dB0p Channel B: 62 dB0p
Harmonic Distortion (at 0 dBr)	<3%
Group Delay	Meets CCITT recommendation M1020
Gain Stability	± 1 dB over 48 hour period
Gain Linearity	± 0.5 dB at input level -30 dBr to 0 dBr
Voice Privacy	Integral
Translation Error	<0.6 Hz

¹ Typical measurements only

² Compander operation doubles the apparent frequency response error.

1.5.5 Link Set-up Time Specifications¹

The link set-up times are of particular importance in the point-to-point mode, especially in a multi-hop situation.

Telephone Operation

Maximum Link establishment time <u>Customer originated call</u> Customer phone 'off-hook' to exchange line looped	Link in non-cycling configuration	900 ms
	Link with exchange terminal in non-cycling configuration and Customer terminal in cycling configuration	1.0 sec.
	Link with both terminals in cycling configuration	1.5 sec
Maximum Link establishment time <u>exchange originated call</u> Ringing tone present at exchange terminal to ringing present at Customer phone	Link in non-cycling configuration	1.0 sec
	Link with exchange terminal in non-cycling configuration and Customer terminal in cycling configuration	1.2 sec.
	Link with both terminals in cycling configuration	1.3 sec

Point to Point Operation

Maximum Link establishment time <u>Basic Point to Point operation</u> M Wire grounded at Base terminal to active E Wire reproduction at Remote terminal (Half-duplex operation)	Make	200 ms
	Break	25 ms
Maximum Link establishment time <u>Trunking Point to Point operation</u> M Wire grounded at Base terminal to establishment of full audio channel over entire link (Full-duplex operation)	Make	330 ms
	Break	710 ms

¹ Typical measurements only

1.5.6 2-Wire Line Interface Specifications

General

Transmit Level Acceptance	-18 dBm to +4 dBm
Receive Level Output Range	-18 dBm to +4 dBm
Impulse Distortion	Fully regenerated signalling 65 ms break, 35 ms make
Hybrid Balance Impedance	600 Ω (Exchange only) or TN12
2-wire Return Loss (against 600 Ω, 900 Ω or BT3 network)	300-3400 Hz = 26dB
Longitudinal Balance	>40 dB
2-wire Voltage Isolation	350 VDC (limited by integral Gas Discharge Arrester)

Customer Terminal

Customer Loop Current	20, 24 or 45mA selectable (nominal 50 VDC)
Loop Detect Threshold	<10 mA (loop detect active during ringing)
Non-Loop Current	3 mA (available for payphone charging current)
Max Loop Resistance	1500 Ω at 50 VDC line supply
Ring Generator Voltage	Unloaded 86Vrms. Loaded (3 REN) 82 Vrms
Ring Generator Frequency	25 Hz $\pm$ 10%
Dial Pulse Acceptance	50-90 ms break, 20-60 ms make (software programmable)
Inter-Digit Gap Acceptance	200 ms minimum (software programmable in 5 ms steps)
Switch Hook Flash	95-500 ms accepted (software programmable in 5 ms steps)

Exchange Terminal Specifications

Max Line Loop	1500 Ω (50 VDC exchange)
Ring Detect Sensitivity	$\leq 50 V_{rms}$ (typically 13 V_{rms}) 16-32 Hz
Ring Equivalent Number	0.5 (REN)
Dial Pulse Timing	65 ms break, 35 ms make (programmable in 5 ms steps). Fully regenerated
Interdigital Pause	800 ms (programmable in 5 ms steps)
Generated Hook Flash	350 ms (programmable in 5 ms steps)

Meter Pulse Option

Detect Threshold	50 mV _{rms}
Frequency Tolerance (12 kHz or 16 kHz meter pulses)	± 50 Hz

1.5.7 4-Wire Plus E and M Line Interface

Receive Level Output Range	-18 dBm to +4 dBm	
Transmit Level Acceptance	-18 dBm to +4 dBm	
M-wire Characteristic	Selectable 48 V, -48V, +5V S/C current ≥ 3 mA to equipment frame	
E-wire Characteristic	Polarity independent	
Peak OFF State Voltage	200 VDC	
Peak ON State Current	100 mA	
ON State Resistance	<50 Ω (typically 33 Ω)	
4-wire Voltage Isolation	>200 VDC to equipment frame	
Maximum E-wire delay¹	Link not yet established. Make	200 ms
	Link not yet established. Break	25 ms
Maximum E-wire delay¹	Link established. Make	25 ms
	Link established. Break	25 ms

¹ Typical measurements only

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2

Operation of the Link

2.1 Introduction

This section describes how the Hawk Rural Radio Telephone Link operates as a telephone link or as a Point to Point link, and how to access the Hawk software.

2.2 Telephone Link Operation

2.2.1 General

The Hawk is designed primarily to carry telephone traffic. This includes any service that uses the public switched telephone network (PSTN) such as telephones, facsimile machines and dial-up modems. The following are the principal functions involved in the telephone operation mode:

- > When a call is initiated, the modem becomes active and goes through an identification handshake procedure with the controller in the remote Terminal. This involves recognition and acknowledgement of identification by both Terminals. The identification is a field programmable code that ensures the remote Terminal only opens its audio channels for a valid signal from the local Terminal.
- > When the link is established the out-of-band signalling tones are enabled and the modem disabled. The controller then opens the audio path so that the link is fully established.
- > The signalling tones serve different functions depending upon whether they originate in the Exchange or Customer Terminal. Exchange originated signalling tones convey ringing information and payphone information (if required) to the Customer Terminal. Customer originated signalling tones emulate the Customer telephones on-hook and off-hook states. When the Customer is off-hook, the signalling tone is activated, conveying decadic dialling and hook-flash information to the Exchange Terminal.
- > The Customer originated signalling tone also maintains the link. The link powers down when the Customer goes on-hook and the controller shuts off the signalling tone.

2.2.2 Link Set-up and Control

A Hawk link is set-up and controlled by the Type 8080 Controller module in each Terminal. This module also controls the operation of the other modules in each Terminal. Each controller module has an internal modem that it uses to communicate with the controller module at the other end of the link. After a link has been set-up, communication between the controller modules is carried out over the audio channel using "out-of-band" signalling tones. These tones have frequencies outside the usual audio range (300-3400 Hz) and do not interfere with any signals being carried by the channel. Refer to Figure 2.1 "System Operation" overleaf.

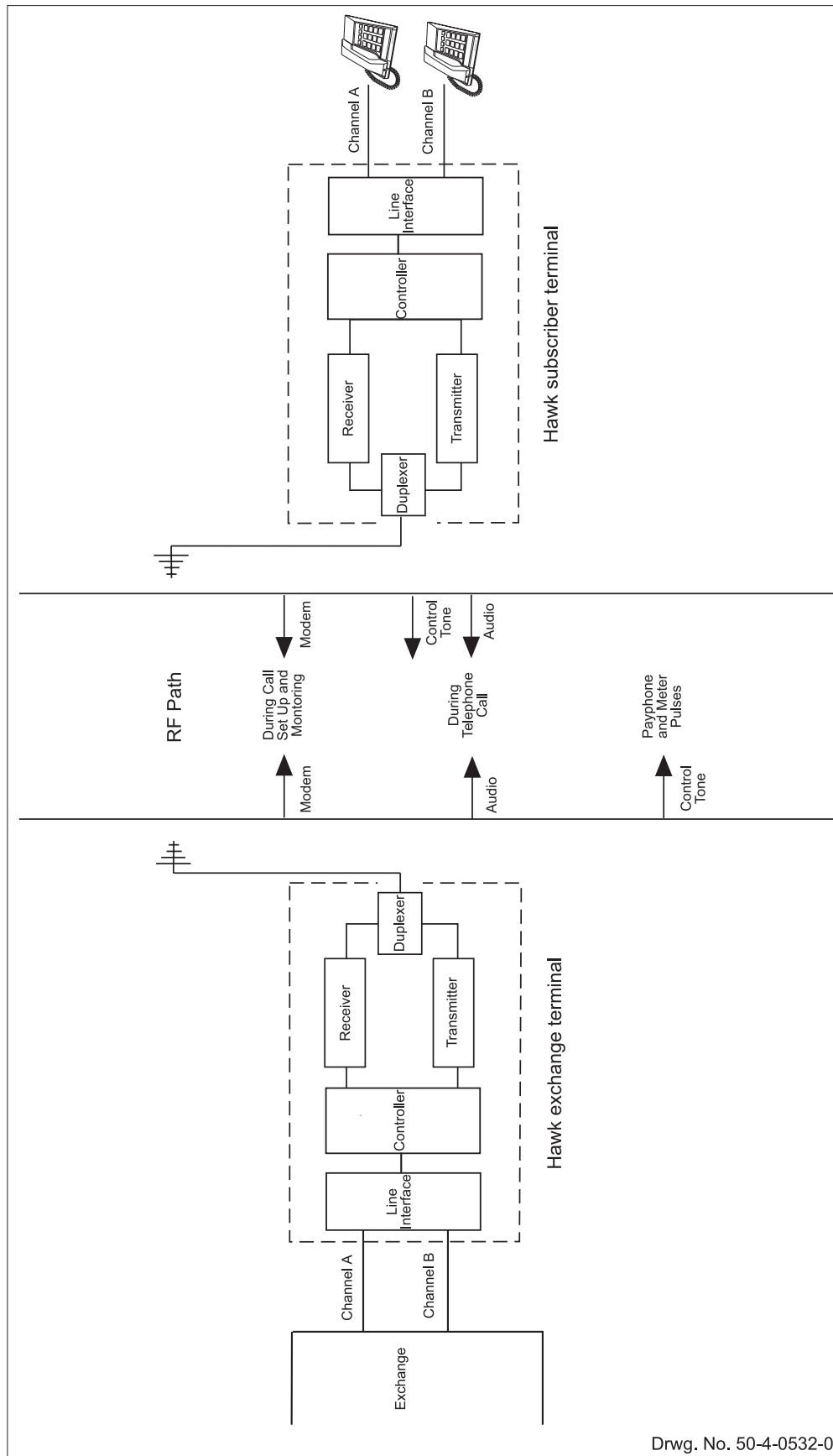


Figure 2.1 System Operation.

2.2.3 Idle State

When the Hawk link is in the idle state, the transmitter modules are unpowered, the Exchange receiver module is fully powered up, the Customer receiver module is normally cycled to save power¹ and most of the circuits in the controller modules are turned off. Apart from the receiver modules, the major circuit block drawing power is the Customer's line supply. The Hawk link remains in this state until one of the following occurs:

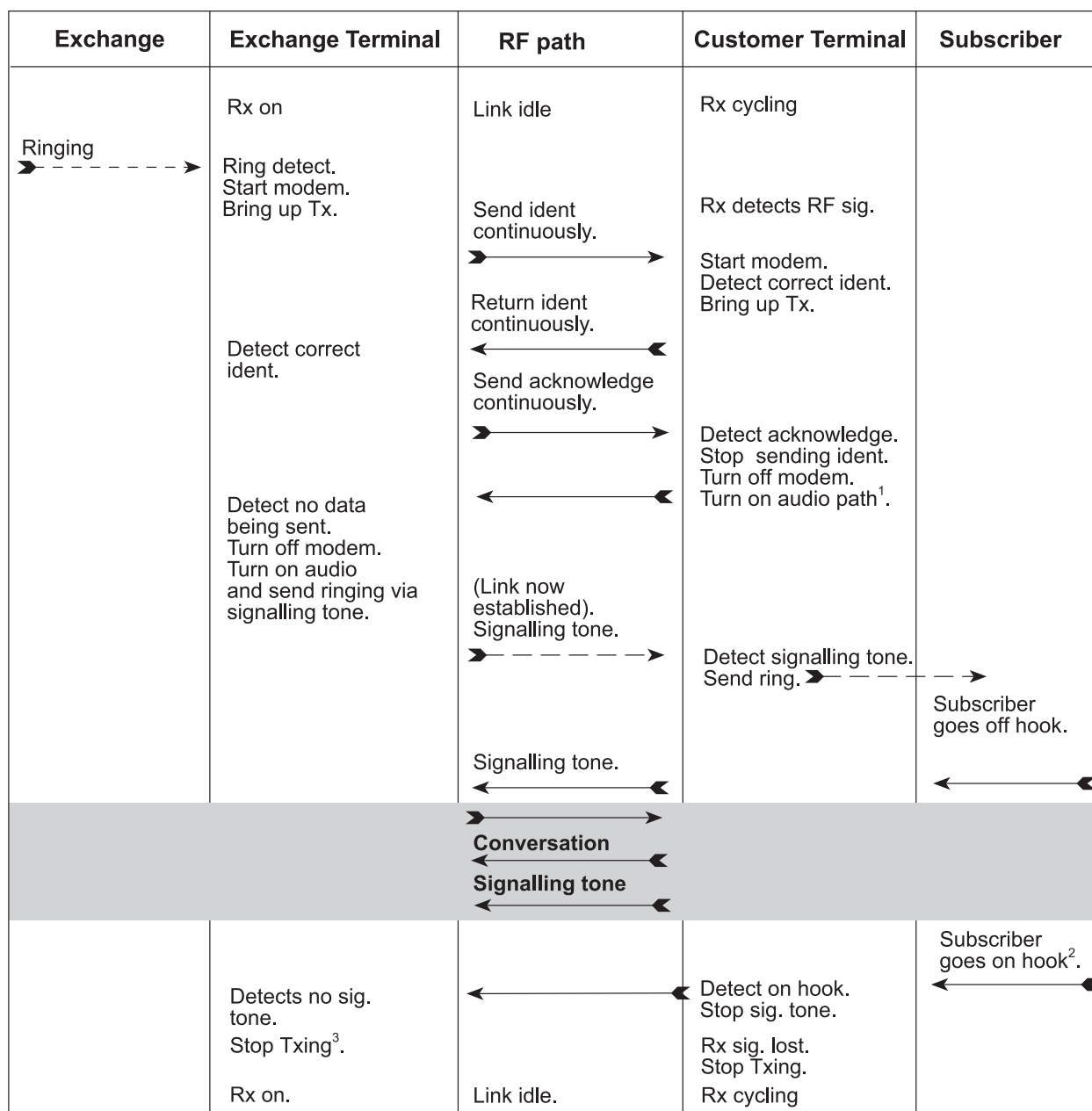
- > The Exchange Terminal detects ringing from the Exchange,
- > The Customer Terminal detects that the equipment it is connected to has gone off-hook.

As a result of either of the above conditions, the opposing Terminal will react to a valid RF signal being detected at the receiver module.

2.2.4 How a Telephone Call is Established

After verification of the input, the Hawk "wakes up" and initiates a link. The process of initiating and establishing a link is detailed in the following two diagrams for both an Exchange originated call and a Customer originated call.

¹ The receiver is switched on and off periodically, usually with the on time being much less than the off time. Hawk receiver cycling is software programmable. Refer to Section 2.11.3 for further details on how to enable receiver cycling.



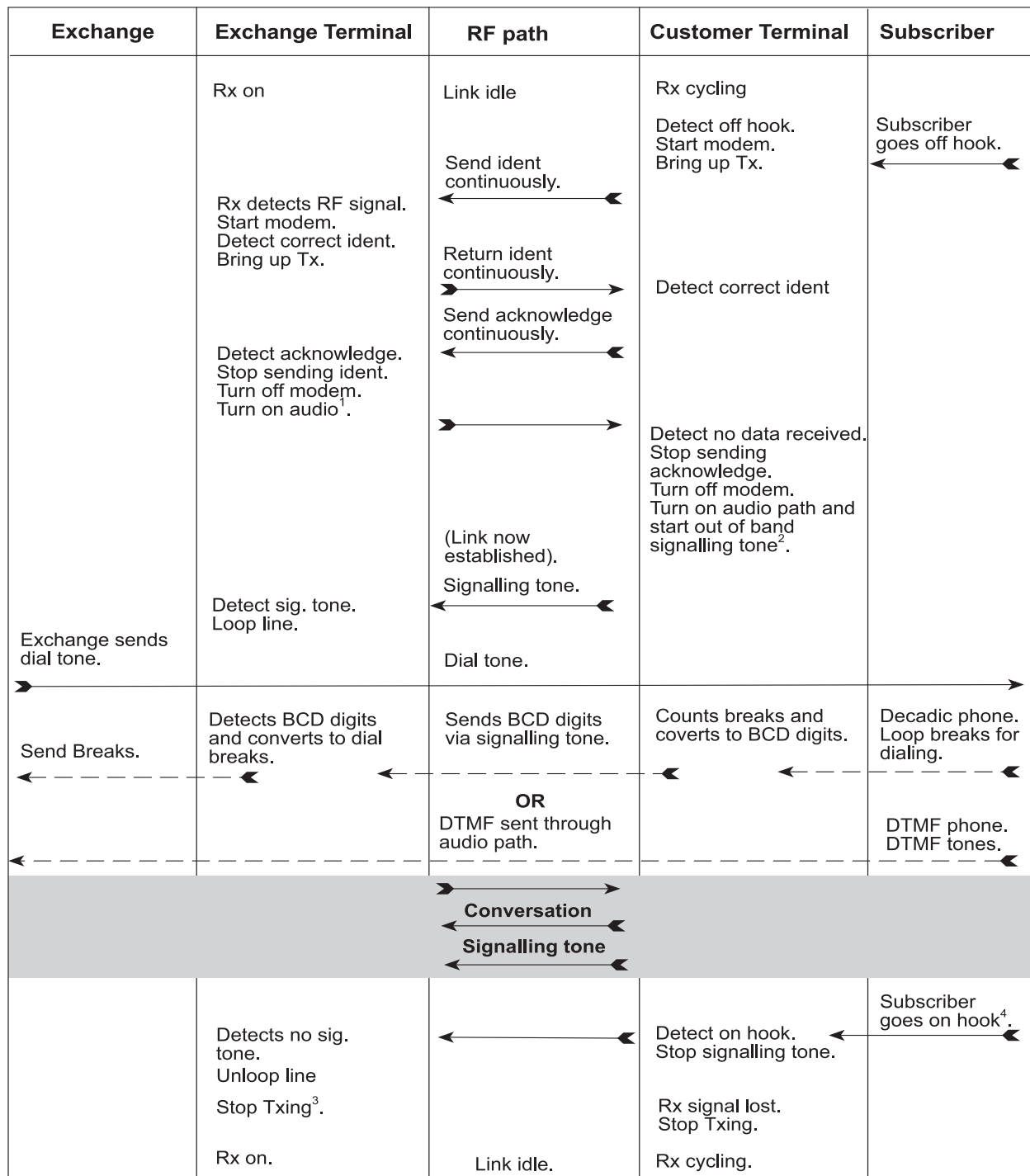
Drwg. No. 50-4-0530-0

Figure 2.2 Exchange Originated Calls

¹ In audio mode the out-of-band signal detector and generator is enabled.

² Only the Customer can end the call.

³ The Exchange always stops transmitting before the Customer.



Drwg. No. 50-4-0531-1

Figure 2.3 Customer Originated Calls

¹ In audio mode the out of band signal detector and generator are enabled.

² The out of band signalling tone (one for each channel) holds the link up when it is in audio mode and the Customer is off hook.

³ The Exchange always stops transmitting before the Customer.

⁴ Only the Customer determines when the radio link shuts down.

2.2.5 Second Channel Set-up

On a Dual Channel Hawk, an Exchange or Customer originated call, on either the A or B channel, sets up the radio link and completes the identification handshake procedure before the DSP switches to its audio mode. Once the RF link is established, there is no need to test for identification.

Therefore, as long as the link is up (i.e. Channel A or B is in use) the Hawk does not check for identification when a call is initiated on the second channel. The second call is established as soon as the Customer's telephone goes off hook, or ringing from the Exchange is detected at the Exchange Terminal.

2.2.6 Payphone Operation

When provided with suitable interface modules, Hawk links can be set-up to operate with 12 or 16 kHz meter pulse payphones, or line reversal payphones. Dual Channel links can have either or both channels set-up to operate with payphones. The only difference between payphone and normal telephone operation is that the Exchange Terminal uses "out-of-band" signalling tones to send costing information to the Customer Terminal. This information is used by the payphone at the Customer Terminal to determine how much to charge the Customer for time elapsed during the call.

2.2.7 Caller Line Identity (CLI) Operation

The Hawk link passes CLI information in either the DTMF or FSK format. The CLI information is sent in the first silent period (the period between the first and second ringing tones).

To ensure the CLI information is received, the speech loops in both the Exchange and Subscriber Terminals must be open at the same time, which in turn means that the first silent period at the Subscriber Terminal must occur at the same time as the first silent period at the Exchange Terminal.

However, due to the link set-up time, the ringing tones and silent periods at the Subscriber Terminal are delayed with respect to those at the Exchange Terminal by a time equal to the link set-up time. Therefore, the duration of the first ringing tone at the Subscriber Terminal is reduced by a period equal to the link set-up time, which in turn synchronises the following ringing tones and silent periods at the Subscriber Terminal with those at the Exchange.

2.2.8 Audible Alarms

As well as carrying the usual PSTN tones, the Hawk link has the facility for generating its own alarm tones to indicate various types of fault. The tones are heard over the link but may also be monitored on test pads located on the motherboard. The table below shows the designated test pad for each alarm.

Alarm	Test Pad
VSWR (Voltage Standing Wave Ratio)	TP115
RSSI (Received Signal Strength Indicator)	TP116
TxPwr (Transmitter Power)	TP117
LowVolts (Low Power Supply Volt)	TP118

Note: The silkscreen on the PCB is incorrect as it has the LowVolts alarm and the TxPwr alarm transposed.

The alarm facility is enabled or disabled by setting the appropriate bit in the Hardware Configuration Byte. For further details, refer to Section 2.11.5.

The alarms and associated corrective actions are as listed below:

- > **Voltage Standing Wave Ratio (VSWR) alarm.** Two beeps every five seconds indicates a problem with the antennas or the cabling between the Terminals and the antennas. Check the cabling, including all connections, and the antenna directions.
- > **Low Received Signal Strength Indicator (RSSI) alarm.** Three beeps every five seconds indicates inadequate received signal strength causing a problem with the path between Terminals. Check the path profile (terrain) between Terminals; ensure there are no obstructions (hills, buildings, forests etc), check that the path length is not excessive, check that the antennas are at optimum heights for the path profile.
- > **TxPwr (Transmitter Power) alarm.** Is not an audible alarm and may only be monitored on the motherboard. The test pad is set to a logic "1" whenever the local transmitter power output level falls below 50% of its maximum. The transmitter power output is also indicated on the front panel LCD (see section 2.6.1)
- > **Low Power Supply Volts alarm.** One beep every five seconds indicates that the power supply voltage to one of the Terminals is below specified levels. Check the external supplies to the Terminals, any power supply unit or converter used with the Terminals and all power supply connections.

If more than one fault is present at one time, the tones for each fault are heard in turn, separated by a five-second gap.

Note: The alarm tones differ in pitch depending on the generating Terminal. Alarm tones generated by the Exchange Terminal are higher in pitch than those generated by the Subscriber Terminal. This allows the user to determine which Terminal is faulty.

2.2.9 Link Fail Alarm

Relay RL101 is located on the motherboard PCB and is controlled via software within the type 8080 Controller module (when configured for Telephone Mode ONLY)

The software allows the integrity of the radio link to be checked; if a link can not be established (link ID not correct or unobtainable) or RSSI is out of specification, RL101 will activate, providing an external output via an RJ45 socket (SK105) as shown in Figure 2.4 below.

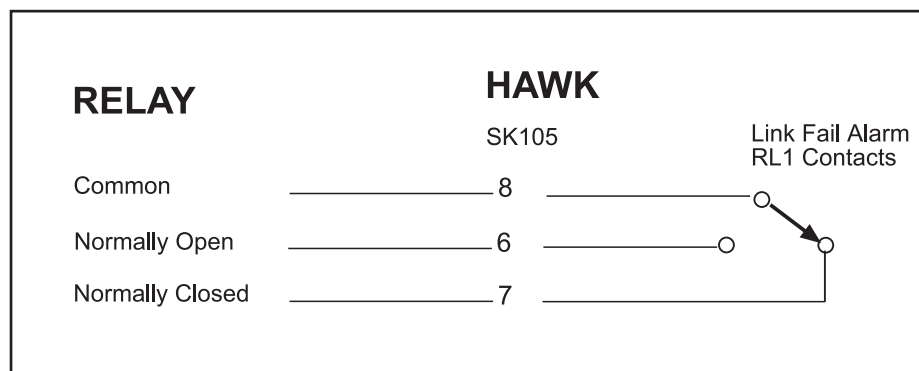


Figure 2.4: Operation of Link Fail Alarm Relay RL101

Note: Although each Terminal is fitted with the Relay and SK105, only the Exchange Terminal will use or access the Link Fail Alarm.

Refer to address 37 in Section 2.11.3 for further information regarding software set-up for this facility.

2.3 Point to Point Link Operation

2.3.1 General

In the Point to Point mode of operation, the Hawk link can be used to replace trunk lines between telephone Exchanges, direct data links or telemetry links.

Point to Point operation requires a 4-wire plus E and M wire line connection at each terminal.

- > The Type 8087 Exchange Line Interface module can provide the 4-wire plus E and M wire line connection for both channel A and channel B.
- > The Type 8088 Subscriber Line Interface module can provide the 4-wire plus E and M wire line connection on channel A ONLY (refer to Section 2.3.6).

For this reason, if Point to Point operation is required on BOTH channels, each terminal **must** contain the Type 8087 Exchange Line Interface module.

A Dual Channel Hawk link can be configured to have both channels set in Point to Point mode (refer to Section 2.3.5) or to have one channel in Point to Point mode and the other in telephone mode (refer to Section 2.3.6).

2.3.2 Link Set-up and Control

As in telephone mode (refer to Section 2.2.2), the Type 8080 Controller module sets up and controls the Hawk Point to Point link.

The link is controlled by the states of the M-wires connected to the Terminals at each end of the link. Each Terminal monitors the state of its own M-wire and uses “out-of-band” signalling tones to send this information to the other Terminal via the RF link.

Note: In Point to Point mode, the Link establishment time must be kept to a minimum, hence, the audio channel is opened once the RF link is first established. There is no “handshake” or Ident code recognition process between Terminals, unlike in Telephone mode.

2.3.3 Idle State

When the Hawk Point to Point link is idle, the modules in each Terminal are powered up, but the Terminals are not actually sending or receiving information. The link remains in this state until one of the following occurs:

- > Grounding of the M Wire line at either Terminal.

Upon receipt of this condition, the Controller module at the initiating Terminal will become active, keying the Transmitter module and transmitting any traffic that is present on the 4-Wire Tx line at the initiating Terminal.

The Receiver module at the corresponding Terminal activates upon detection of a valid RF signal and passes the received traffic out of the 4-Wire Rx line.

Depending on the operating mode, the Transmitter module at the corresponding Terminal may automatically awaken to establish a Full-Duplex path, see below.

2.3.4 How a Point to Point link is established

A Hawk Point to Point link has two possible modes of operation, Trunking and Basic.

- > **Trunking mode** operates in a Full-Duplex manner with communication occurring in each direction simultaneously. Grounding of the M Wire at either Terminal allows data/traffic to be transmitted and received at each Terminal.
- > **Basic mode** operates in a Half-Duplex manner with VF communication normally occurring in one direction only. Grounding of the M Wire at the initiating Terminal allows data/traffic to be transmitted from that Terminal and received at the corresponding Terminal.

Trunking (Full Duplex Operation)

When operating in Trunking mode, a Hawk link is often used to connect two telephone Exchanges.

1. The Hawk link is in the idle state, as described in Section 2.3.3,
2. One of the Terminals receives a valid M-wire input from its Exchange,
3. The M-wire keys the transmitter module to transmit the signal on its line connection, and the M-wire status, to the remote Terminal at the other end of the link. The line signal is sent on the link audio channel, and M-wire status is sent using “out-of-band” signalling tones,
4. The receiver module in the remote Terminal detects the RF signal. It sends the information on the audio channel to the Exchange via its line connection. It also produces an E-wire valid output from the M-wire status information in the out-of-band signalling tones,
5. The controller module detects the valid E-wire from the receiver module, and uses it to derive an M-wire signal to the transmitter module,
6. The M-wire signal keys the transmitter module to transmit the signal on its line connection, and the local M-wire status, to the local Terminal at the other end of the link. The link is now set-up,
7. The link remains set-up as long as there is a valid external M-wire input at either Terminal. If there has been no such input within the set time-out period¹, the link closes down.

Basic (Half Duplex Operation)

When operating in Basic Point to Point mode, a Hawk link is often used for data transmission or telemetry.

1. The Hawk link is in the idle state, as described in Section 2.3.3,
2. One of the Terminals receives a valid M-wire input from its Exchange,
3. The M-wire keys the transmitter module to transmit the signal on its line connection, and the M-wire status, to the remote Terminal at the other end of the link. The line signal is sent on the link audio channel, and M-wire status is sent using “out-of-band” signalling tones.

¹ The time-out period is software programmable. Refer to Section 4 for further details.

4. The receiver module in the remote Terminal detects the RF signal. It sends the information on the audio channel to the Exchange via its line connection. It also produces an E-wire valid output from the M-wire status information in the out-of-band signalling tones,

The operation of the Basic Point to Point link differs from Trunking Point to Point link in that the controller modules in the Terminals do not derive an M-wire signal from the receiver E-wire. This means that the return path is not automatically activated, but requires an active M-wire to be externally input to the Terminal.

2.3.5 Dual Channel Operation

The Hawk Link can be configured to have each Channel set for either Basic or Point to Point operation.

When the link is in the idle state, a Point to Point link made using either channel will be set-up and controlled as described in Section 2.3.4.

As the RF link has already been set-up due to the activation of the first operating channel, the second channel will be connected without requiring the same set-up procedures.

The link will not shut-down while either channel is still carrying information.

2.3.6 Mixed Mode

A dual channel Hawk link can have one audio channel in Point to Point mode and the other in Telephone mode. This is known as Mixed Mode operation.

- > If Mixed Mode operation is required, one terminal must contain the Type 8087 Exchange Line Interface module and the other terminal **must** contain the Type 8088 Subscriber Line Interface module.



In Mixed Mode, Channel A must be configured for Point to Point operation and Channel B must be configured for Telephone operation.

Refer to Section 2.9 for further details concerning Ident Code selection.

When the link is in the idle state, a Telephone or Point to Point link will be set-up and controlled as described in Sections 2.2.4 or 2.3.4.

As the RF link has already been set-up due to the activation of the first operating channel, the second channel will be connected without requiring the same set-up procedures.

The link will not shut-down while either channel is still carrying information.

2.3.7 Alarms

The alarm tones described in Section 2.2.8 are available during Point to Point operation, with the following additional facilities:

- > **High/Low Tones.** The pitch of the tones generated at either Terminal can be set to distinguish them from those generated at the other Terminal. This enables the listener to identify which Terminal is faulty. The tone pitch facility is enabled or disabled during Point to Point configuration, as described in Section 2.9.2.
- > **External Alarms.** All alarms may be monitored on test pads that are located on the motherboard. Refer to section 2.2.8 for more information.

The VSWR and Low RSSI alarms may be sent via low current open collector outputs to external ports at each Terminal rather than being audible across the link. This will allow connection to external circuitry, which control external alarm indications (such as bells, lights etc)

The alarms appear on the connectors used for the Payphone Interface cards, the VSWR alarm goes to the Channel A connector (J101, Pin 7) and the Low RSSI alarm goes to the Channel B connector (J102, Pin 7). The External Alarms are set during Point to Point configuration, as described in Section 2.9.2.

Notes:

1. If the External Alarms facility is enabled, no audible alarm tones are sent over the link.
2. The Low RSSI alarm is not available if Channel B of a mixed mode Point to Point link is being used to support a payphone (the Channel B Payphone Interface connector is in use).
3. The Low Power Supply Volts alarm normally cannot be provided as an external alarm as there is no connector available for it

2.4 System Software

2.4.1 General

The system software contained in the Controller is an integral part of the system intelligence. The Controller software together with the DSP allows the Controllers at each Terminal to communicate with one another.

The software defined in this section covers the version **2.30** series.

Meter Readings

The analogue to digital converter within the Controller allows monitoring of various selectable points in the Transmitter, Receiver and Controller modules. The monitored levels are output either via the LCD display on the module front panel or the RS232 port (via RJ45 socket SK106)

The Controller has an internal modem that allows the meter readings from the remote Terminal to be displayed at a local Terminal when a test link has been established (refer to Section 2.8)

Adjustable System Parameters

System parameters such as receiver cycling, dial timing and other controller operations can be viewed, altered and stored in the EEPROM. (refer to Section 2.11.3)

Altering the EEPROM contents is normally done when the system is first installed, or if you are experiencing problems.

Note: Unless the Customer telephone line is already off-hook, access to any of the Hawk menu functions will automatically lock out the normal Customer telephone circuit.

This condition will persist until the Hawk menu is de-activated by pressing <Enter> when the Menu shows “**OFF**” and the screen goes blank.

Please ensure at all times that the Hawk is returned to “Sleep mode” after use of the menu functions so that normal Customer telephone traffic can resume.

The Hawk Terminal will automatically revert to “Sleep mode” if left unattended for a period in excess of 5 minutes.

This “Diagnostic Hold Up Time” is user programmable, refer to address 33 in Section 2.11.3 for further information.

2.4.2 Accessing Controller Functions

Controller functions are available via a continuous loop menu. Functions in the menu include:

- > Displaying meter readings,
- > Conducting operational tests for set-up or fault-finding,
- > Changing operational parameters,
- > Displaying status from the local and remote Terminal.

Functions can be accessed by using one of the following:

- > The push buttons and four digit LCD on the module front panel,
- > A Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) to access information via the RS232 port (via RJ45 socket SK106)

2.4.3 Front Panel Access

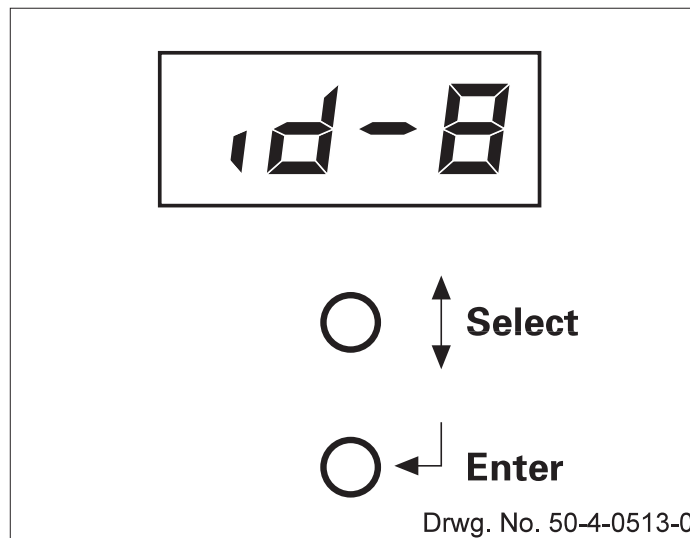


Figure 2.5 Controller front panel

The front panel buttons allow the user to scroll through the menu as follows:

- > Press the top button “Select” to wake up or activate the Terminal if the LCD is blank,
- > Press the top button when the link is awake to move forward through the menu,
- > Hold the top button down while pressing and releasing the bottom button to scroll backward through the menu,
- > Press the bottom button “Enter” to activate the current menu item displayed. Press it again to deactivate it.
- > To deactivate the Hawk, scroll back through the menu until “OFF” is displayed on the LCD, and then press the bottom button. The LCD will go blank.

2.4.4 Laptop PC Menu Access

It is possible to access the menu via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) to access information via the RS232 port (via RJ45 socket SK106)

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.10 or Appendix D for pin-out details.

Theory of Operation

When the Hawk is in the idle state, press any key to active the PC display and follow the on screen instruction for the modem wake-up sequence. Please note the default¹ instruction is "Press the "A" key three times".

After a short delay the headings "Prev", "Next" and "Enter" are displayed on the screen.

The currently selected item of the scroll-through software menu is shown under the "Enter" heading. The item immediately prior is shown under the "Prev" heading and the item immediately following is shown under the "Next" heading.

You can scroll through the menu items by pressing the following keys:

- > "P" selects the previous menu item,
- > "N" selects the next menu item,
- > "Enter" activates the currently selected menu item; pressing "Enter" once again returns to the scroll-through menu.

2.4.5 Link Status

Access to Controller functions is determined by the status of the link. The three types of status are:

- > A normal telephone link is established (allowing local meter reading access only)
- > No link is established and both ends are inactive (local meter readings can be viewed and local system parameters viewed and altered)
- > A test link is initiated, activating a remote Terminal, which comes up in slave mode. (local/remote meter readings can be viewed and local/remote system parameters can be viewed and altered)

Test Link Commands

The test link commands are F0 (this forces a test link irrespective of the ident code) or F1 (checks the ident code of each Terminal first before establishing a link).

Refer to Section 2.8, "Test Link Functions" for further details.

2.4.6 Link Menu Options

Once the Controller is active, three options are available depending on the link status. The options are detailed in the table overleaf.

Note: Some options are not available if you are using the buttons on the front panel of the controller module.

¹ It is possible to change the modem wake-up sequence. Refer to address 31 in Section 2.11.3 for further information

	Normal Phone Link		No Link		Test Link	
	Terminal	LCD	Terminal	LCD	Terminal	LCD
Common Meter Reading	L.RSSI:	0-	L.RSSI:	0-	L.RSSI:	0-
					R.RSSI:	1-
	L.VSWR:	2-	L.VSWR:	2-	L.VSWR:	2-
					R.VSWR:	3-
	L.TxPw:	4-	L.TxPw:	4-	L.TxPw:	4-
					R.TxPw:	5-
Test Link Functions			Ch A. CAL	8-		
			Ch B. CAL	9-		
			Force a link:	F0 -		
			Establish link:	F1 -		
			Adaptive Balance ¹	F4	Cleardown link:	F2
			Tx Meter Cal.	F8	Anten align:	F3
Common System Parameters			Terminal Test	F9	Tx Meter Cal.	F8
			ID code:	id-	ID code:	id-
			PP1 code:	PP1	PP1 code:	PP1
All Meter Readings			PP2 code:	PP2	PP2 code:	PP2
	L.Con0 to 7:	c0 to 7	L.Con0 to 7:	c0 to 7	R.Con0 to 7:	c0 to 7
	L.Rx0 to 7:	r0 to 7	L.Rx0 to 7:	r0 to 7	R.Rx0 to 7:	r0 to 7
System Parameters	L.Tx0 to 7:	t0 to 7	L.Tx0 to 7:	t0 to 7	R.Tx0 to 7:	t0 to 7
			Go to sleep	OFF		
			L.Ser#	-	L.Ser#	-
			Alt L.Sys-Param	-	Alt L.Sys-Param	-
			Change password	-	Change password	-
					R. Ser#	-
					R. Ver#	-
					Clone Ph Times	-
					Alt. R.Sys-Param	-
			Load parameters	-	Load Parameters	-

¹ Note that although F4 (2-wire adaptive balance) appears after Test Link Function F3, it is NOT available when a Test Link or Normal Phone Link is active. It is ONLY available when No Link is active.

2.5 Deactivating the Hawk

If the Hawk is in "Test Link" or "No Link Established" mode, it will close down after a time out period after the last button has been pressed (approximately five minutes).

To deactivate the Hawk via the module front panel, scroll through the menu to "Off" and press the bottom button.

To deactivate the Hawk via the Laptop PC, either "Q" on the keyboard, or scroll through the menu until you reach "Go to sleep" and then press "Enter".

2.6 Meter Readings

Either the most common meter readings, or all meter readings can be accessed via the menu as follows:

2.6.1 Common Meter Readings

The most commonly used meter readings have been selected from "All Meter Readings" and are displayed as a separate menu. The left digit indicates the meter position and is a value from 0-9. The right two digits indicate the value from 00 to 99.

An example of a common meter reading on the LCD is shown in Figure 2.6. The PC shows the information in a different way, e.g. L.RSSI: 68%.

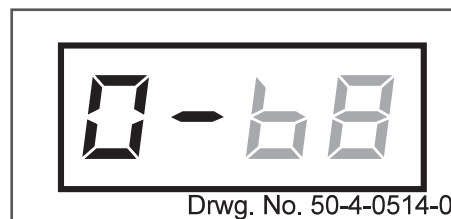


Figure 2.6 Meter reading on the LCD

The common meter readings are shown in the following table.

Note: If the link is in "No Link Established" mode, you will only see local readings, positions 0, 2, 4, 8 and 9 (on the LCD).

Terminal	LCD	Description
L.RSSI	0	Local received signal strength indication.
R.RSSI	1	Remote RSSI if a test link has been established.
L.VSWR	2	Local VSWR (if a link is not established the display will show "- -" as the transmitter is not powered up and a reading can not be taken. If you want to take a reading, press the bottom button on the front panel or "Enter" on the PC keyboard. The transmitter will power up briefly, take a reading and the transmitter will switch off again).
R.VSWR	3	Remote VSWR if a test link has been established.

L.TxPw	4	Local transmitter power (if a link is not established, the display will show “- -” as the transmitter is not powered up and a reading can not be taken. If you want to take a reading, press the bottom button on the front panel or “Enter” on the PC keyboard. The transmitter will power up briefly, take a reading and the transmitter will switch off again).
R.TxPw	5	Remote transmitter power if a test link has been established.
ChA.Cal	8	Used to measure the channel A transmit and receive line levels when setting up the line interface. Refer to Section 4.5.2.
ChB.Cal	9	Used to measure the channel B transmit and receive line levels when setting up the line interface. Refer to Section 4.5.2.

Note: It is recommended that the common meter readings are recorded during the installation procedure. Refer to Section 3.10 for details.

2.6.2 All Meter Readings

This option enables you to scroll through local and remote meter readings. The left digit will be “c” (Controller), “r” (Receiver) or “t” (Transmitter). The next digit is the meter number and the right two digits are a meter reading from 00 to 99.

Examples of local and remote meter readings are shown in Figures 2.7 to 2.10.

Note: The decimal point after the letter indicates it is a remote meter reading. You must establish a link to access remote meter readings.

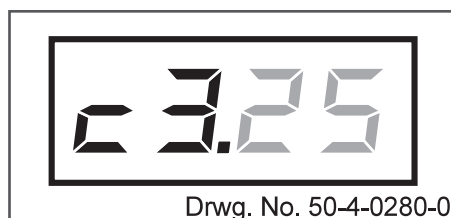


Figure 2.7 Local Controller Meter reading on the LCD

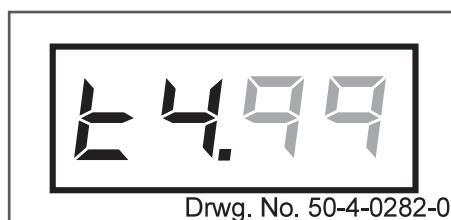


Figure 2.8 Local Transmitter Meter reading on the LCD



Figure 2.9 Remote Transmitter Meter reading on the LCD



Figure 2.10 Remote Receiver Meter reading on the LCD

The Laptop PC will display the meter readings with “L” indicating local and “R” indicating a remote reading. For example:

- > L.Con 3: 25%,
- > L.Tx 4: 99%,
- > R.Tx 4: 99%
- > R.Rx 0: 73%.

2.6.3 Controller Meter Readings

Note: Typical values will lie between the grey shaded areas shown on Figures 2.11 to 2.15 inclusive.

Meter Reading c0: Channel A Audio Send

Displays the channel A audio level sent over the link.

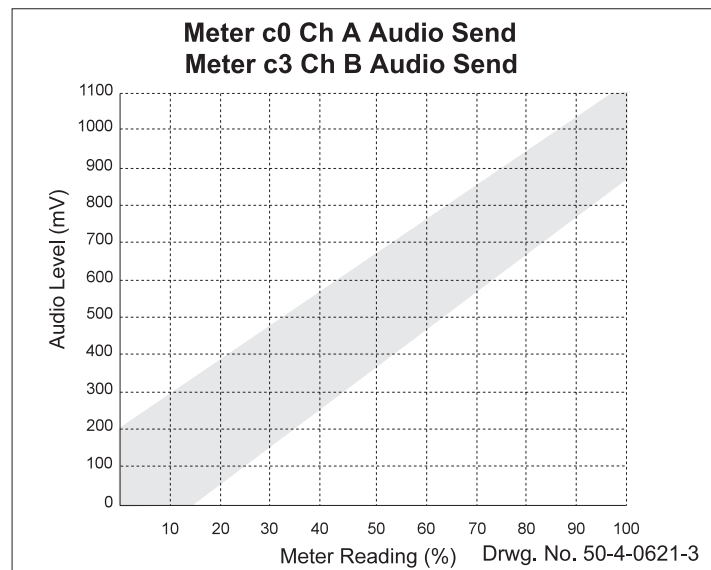


Figure 2.11 Meter Reading c0 - Channel A Audio Send & c3 - Channel B Audio Send

Meter Reading c1: +12 V DC

Allows you to monitor the +12V DC supply voltage. The Hawk will not operate below 10.5V and internal damage may occur if an input voltage greater than 15.5V is applied.

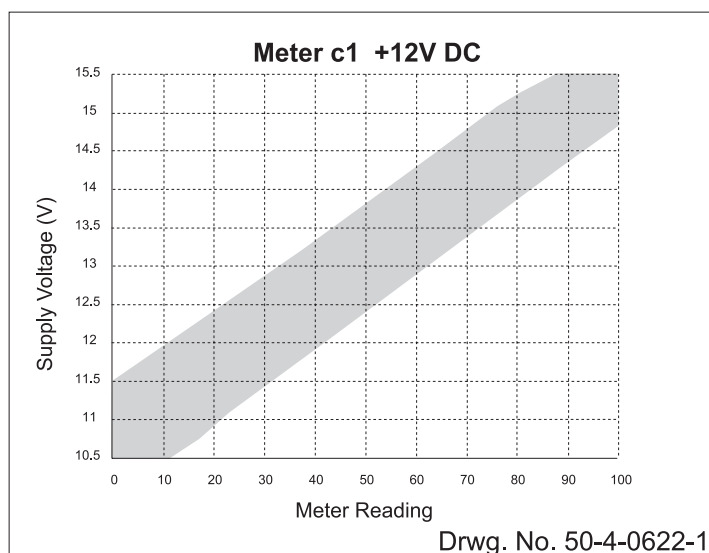


Figure 2.12 Meter Reading c1 - +12V DC

Meter Reading c2: Channel A Audio Receive

Displays the level of audio received from the link for channel A. This reading is taken before the compandor.

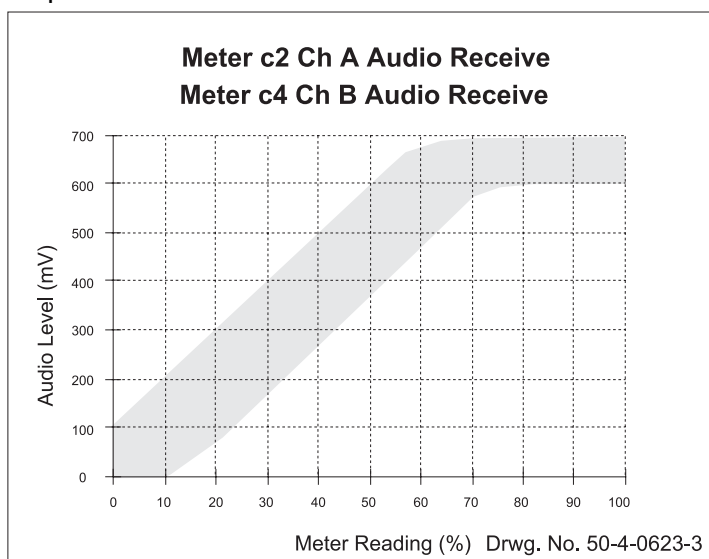


Figure 2.13 Meter Reading c2- Channel A Audio Receive & c4 - Channel B Audio Receive

Meter Reading c3: Channel B Audio Send

This reading is similar to c0, except the send level of channel B is displayed.
(refer to Figure 2.11)

Meter Reading c4: Channel B Audio Receive

This meter position is similar to c2, but channel B audio receive level is displayed.
(Refer to Figure 2.13)

Meter Reading c5: Receiver Output Level

Displays the baseband signal level arriving at the DSP circuit from the receiver module. This includes audio for both channels, plus signalling tones.

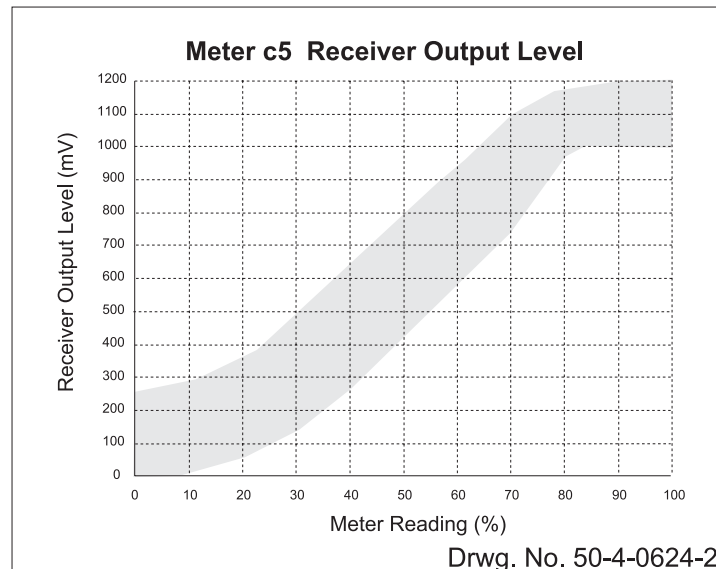


Figure 2.14 Meter Reading c5 - Receiver Output Level

Meter Reading c6: Transmitter Modulation Level

Displays the level of baseband signal sent from the DSP circuit to the transmitter module. This signal includes audio for both channels, plus signalling tones.

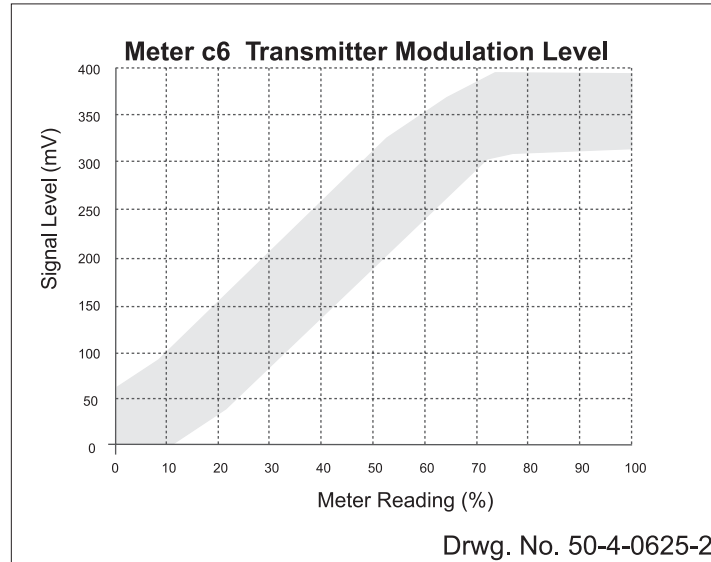


Figure 2.15 Meter Reading c6 - Transmitter Modulation Level

Meter Reading c7

This position is not used and will always read zero.

2.6.4 Receiver Meter Readings

Meter Reading r0: RSSI (Received Signal Strength Indicator)

Displays the RF level at the receiver module.

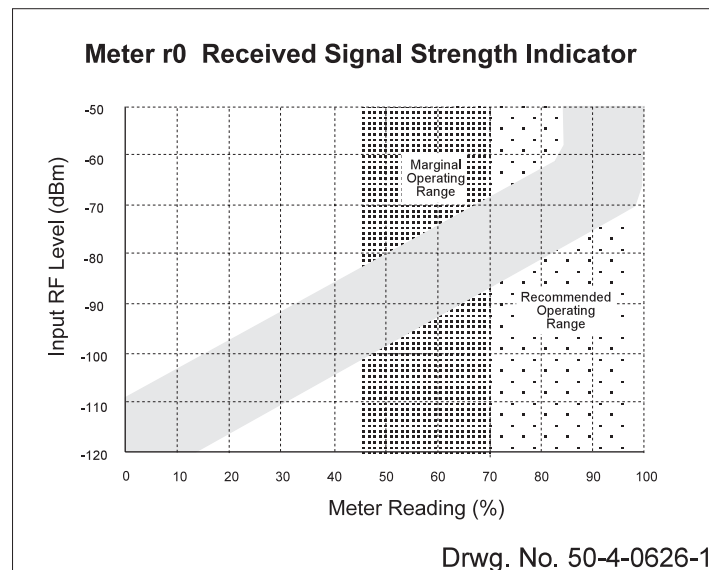


Figure 2.16 Meter Reading r0 - Received Signal Strength Indicator

Note: A label showing an RSSI graph is attached to the bottom of the wall mount cover, adjacent to the Duplexer connector. This graph relates directly to the specific Receiver module within the Terminal, identified by the relevant serial number.

A copy of the same graph is also attached to the Receiver Module shroud and can be seen once the wall mount cover is removed.

Meter Reading r1

This position is not used and will always read zero.

Meter Reading r2: Lock Detect

Displays either 0% or 99%. 0% indicates the receiver synthesiser is locked. 99% indicates the synthesiser is out of lock and the receiver will not operate.

Meter Reading r3: Loop Volts

Displays the tuning voltage applied to the receiver synthesiser. A reading between 40 and 60% normally indicates correct operation.

Meter Reading r4 to r5

These positions are not used and will always read zero.

Meter Reading r6

Will display a figure between 0 and 99. Functionality not yet implemented.

Meter Reading r7: Turndown Power

Indicates if the receiver is sensing input overload from the local transmitter. A reading below 99% indicates that the duplexer requires alignment.

2.6.5 Transmitter Meter Readings

Meter Reading t0: Forward Power

Displays the percentage of output relative to the last time the meter was calibrated. (Refer to Section 2.10). A reading below 99% indicates a drop in output power since calibration.

Meter Reading t1: VSWR

Displays the VSWR at the transmitter output as a percentage. The lower the number the better the match. A reading of less than 50% should be achieved.

Meter Reading t2: Lock Detect

Displays 0% or 99%. 0% indicates the transmitter synthesiser is locked. 99% indicates the transmitter synthesiser is out of lock and the transmitter will not operate.

Meter Reading t3: Lock Volts

Displays the tuning voltage applied to the transmitter synthesiser. A low reading (e.g. 20) indicates the transmitter is tuned to the low end of the band while a high reading (e.g. 70) indicates it is tuned to the high end of the band.

Meter reading t4: Deviation Control

This measures a correction voltage applied to the transmitter synthesiser, and is used during manufacture.

Meter Reading t5: Driver

Is an indication of the driver output and is used during alignment.

Meter Reading t6: Temperature

Displays the temperature of the power block heatsink in °C. If the temperature exceeds 95°C, the transmitter output power is reduced to prevent damage or early failure.

Meter Reading t7: +10V DC

This measures the transmitter's internal 10 volt regulator and should read 99%.

2.7 2-wire Adaptive Balance Function

A software feature in the 8080 Controller module will allow the user to perform 2-Wire adaptive hybrid balancing once each Terminal has been successfully configured and installed. This feature is designed to improve performance of the Hawk Link when used with cable lengths of 1 km or more.

Note: Performing the adaptive balance procedure is not recommended for cable lengths of less than 1 km as this could degrade performance.

Refer to Section 4.10 for details.

2.8 Test Link Functions

Test link functions are only available if a test link has been established. This is done by forcing a link (F0) or establishing a link (F1).

The menu options available will depend on whether you want to monitor or adjust the remote Terminal parameters. An example of a test link function on the Controller front panel LCD is shown below.



Figure 2.17 Test link functions on the LCD

The left digit is F indicating function, the next digit is the function number and the right two digits are a meter reading range from 00 to 99. Press the bottom button to activate the function and press it again to exit the function.

Note: Once the link is established, press the bottom button on the Controller to select a function.

The PC display will show a different message for each function and "Enter" is pressed to activate the function. Refer to the following table for further details.

Terminal	LCD	Description
Force a link	F0	Establishes a test link without requiring ident codes. It is used when you do not know the remote Terminal's ident code. The right hand digits do not display until a link is established and then shows the remote Terminal's ident code.
Establish a link	F1	Establishes a test link using ident codes. The right hand digits do not display until the link is established and then shows the ident code.
Cleardown link	F2	Takes the link out of test link mode. The local Terminal returns to F0 and the remote Terminal goes to sleep.
Antenna align	F3	Adjusts the antenna position for maximum received signal. The remote transmitter continues transmitting, but the local transmitter switches off. The right hand digits are blank until the remote transmitter accepts the command and then shows RSSI.

Transmitter meter calibration	F8	Used to set the full scale meter position for local transmitter forward power readings
Terminal Test	F9	Used to evaluate the performance of the link without activating a call. In Terminal test the receiver is powered, transmitter active, receiver and audio mutes are released and the speech loop relays are energised. Signalling or alarm tones are not generated so any link noise measurements made are not valid for normal link operation. Transmitter deviation is reduced by approximately 650Hz due to the absence of signalling tones. Most of the other performance characteristics can be measured in this mode including audio responses, return loss etc. If required, transmitter or receiver modules can be unplugged to disable them.

2.9 Checking/changing the Ident Code

The procedures below explain the method for checking/changing the ident code that is set for Telephone or Point to Point operation.

The Ident Codes for Channel A and Channel B are software selectable within the Type 8080 Controller module.

Note: Each Terminal must be set for the same code for correct link operation.

If you intend to use the Hawk for a Point to Point (non-telephone) operation, you must set the ident code to "P" instead of a number from 0 to 9

2.9.1 Telephone Operation

The ident code is the identification number for the link. There are 10 possible identification numbers available from 0-9.

An example of the ident code display on the LCD is shown below.

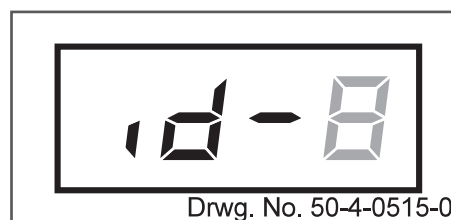


Figure 2.18: Ident code on the LCD

2.9.2 Point to Point Operation

In a Point to Point link, each audio channel has its own Point to Point code. PP1 is used for Channel A while PP2 is used for Channel B.

An example of the Point to Point mode on the LCD is shown below.



Figure 2.19: Point to Point mode

The code combinations available for PP1 or PP2 are displayed in the table below.

Mode	Code	Description
PP1	0	Basic
	1	Trunking
	4	High alarm tones
	8	External alarms
PP2	0	Basic
	1	Trunking
	8	Telephone

The codes for each mode are added together and converted to a single hexadecimal digit for each channel.

For example:

- > If Channel A (PP1) required Basic Point to Point operation using high alarm tones, the code would be 4 in hexadecimal (0 + 4)
- > If Channel B (PP2) required Trunking Point to Point, the code would be 1 in hexadecimal.

The hexadecimal code conversions are shown in the table below.

Hex Digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

2.9.3 Procedure using the 8080 Controller module front panel buttons and LCD

Note: The following instructions assume that the Hawk Terminal has already been removed from its mounting to allow the wall mount cover to be removed as detailed in Section 4.6.

Note also that it is necessary to re-apply DC power to the Terminal to allow the Ident Code to be checked/changed.

Step	Action
1	Press the top button on the module if the LCD is blank. This activates the Terminal. Continue to press the top button until the LCD displays "id-x" (where x is the ident code 0-9 or P).
2	To change the ident code, press the bottom button and the LCD will flash. Press the bottom button until the desired code appears on the LCD (refer to Section 2.9.2 if necessary to determine the required code for Point to Point operation).
3	Hold the bottom button down until the LCD stops flashing (approximately five seconds) The code is now changed.
4	Press the top button until the LCD displays "OFF". Press the bottom button until the LCD goes blank.

2.9.4 Procedure using a Laptop PC or Video Display Terminal

It is possible to check or amend the ident code via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) or an ASCII Video Display Terminal (VDT) to access information via RJ45 socket SK106.

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.10 or Appendix D for pin-out details

Step	Action
1	Press any key on the PC or VDT if the screen is blank. This activates the Terminal and display instructions for the wake-up sequence. The <u>Default</u> ¹ instruction is for the operator to enter the 'A' key three times.
2	Press "N" on the keypad until the screen displays "ID code: x" (where x is the ident code 0-9 or P).
3	Press "Enter" and the prompt "Old Ident x Enter 0-9 or P:" is displayed.
4	Enter the new ident code using the keypad. The ident code is changed when the screen displays "ID code: x" where x is the new code. Press "Q" or "N" on the keypad until the screen displays "Go to sleep" then press "Enter". The Terminal is now turned off.

¹ It is possible to change the modem wake-up sequence. Refer to address 31 in Section 2.11.3 for further information

2.9.5 Mixed Mode Operation

As described in Section 2.3.6, a Dual Channel Hawk link can have one audio channel in Point to Point mode and the other in Telephone mode.



CAUTION

In this mode, Channel A must be configured for Point to Point operation and Channel B must be configured for Telephone operation.

Step	Action
1	Follow the procedure(s) shown above to configure Channel A (PP1) for Point to Point operation, setting the code to the required Hex number (refer to Section 2.9.2)
2	Follow the procedure(s) shown above to configure Channel B (PP2) for Telephone operation by setting the code to "8" (refer to Section 2.9.2)

2.10 Calibrating the Transmitter Forward Power Meter

The transmitter forward power meter reading shows 99% for full power. If you have to adjust the transmitter for a different power output or install a new transmitter, the meter reading will no longer be correct. You must then re-calibrate the meter reading against the actual power output.

An example of the LCD screen to calibrate the transmitter is shown below.

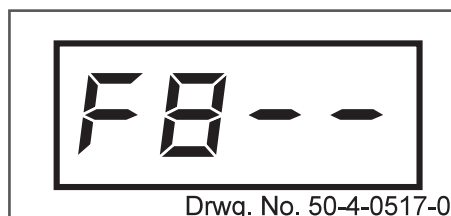


Figure 2.20: Calibrate the transmitter meter screen

Follow one of the procedures below to calibrate the transmitter power.

2.10.1 Procedure using the 8080 Controller module front panel buttons and LCD

Step	Action
1	Scroll through the menu using the top button until you see "F8".
2	Press and release the bottom button and the display will flash.
3	Press and hold the bottom button until the display stops flashing (approximately five seconds).
4	The transmitter meter reading is now calibrated to display 99% at the current power output

Note: If you do not hold the bottom button down until the display stops flashing, the meter will not be calibrated.

2.10.2 Procedure using a Laptop PC or Video Display Terminal

Step	Action
1	Press any key on the PC or VDT if the screen is blank. This activates the Terminal and display instructions for the wake-up sequence. The <u>Default</u> instruction is for the operator to enter the 'A' key three times.
2	Press "N" on the keypad until the screen displays "Tx meter Cal".
2	Press "Enter". The display changes to "Y to confirm".
3	Press "Y" and the meter is calibrated.
4	Press "Q" until it shows "Go to sleep" and press "Enter" to turn off the local controller.

2.11 PC or Video Display Terminal Functions

The following functions can only be accessed using a Laptop PC or VDT. When accessing the functions, a horizontal bar is displayed on the Controller's LCD.

A password must be entered to view or change adjustable parameters (the factory default password is TELSTRA)

Note: If you want to reload the factory default parameters, you do not need to enter the password. The password is then reset to TELSTRA.

2.11.1 Local Functions

Function	Description
L.Ser # 123456	Displays the local serial number (6 digit serial number).
Alter L.Sys Param.	Displays the local system characteristics (receiver cycling, dropout time, options fitted etc). The Hawk will first prompt you for the EEPROM address and show you what is currently stored. You have the option to alter the parameter. Refer to "Non-volatile Memory Parameters" table. (Section 2.11.3)
Change password	This option changes the password for the controller. The Hawk will prompt you for the new password.
Load parameters	This option resets all system and telephone timing parameters in the EEPROM to the <u>Telstra</u> factory <u>default</u> settings. (refer to address 58 in Section 2.11.3) Serial number, ident code, hardware type and Point to Point parameters <u>do not</u> change.

2.11.2 Functions Available With a Test Link

Function	Description
R.Ser #	Displays the remote serial number, press "Enter" to activate.
R.Ver	Displays the remote software version, press "Enter" to view.
Clone Ph. timing	Copies the telephone timing characteristics of the local Terminal to the remote Terminal when you press "Enter". After the transfer is completed, the display will read "OK".
Alter R.Sys Param	Displays or changes remote system characteristics and operates in the same way as Alter Local System Parameters above.

2.11.3 Non-volatile Memory Parameters

System parameters are stored at specific address locations within the EEPROM. The micro-controller reads the stored information to obtain the required figures.

Note: The values stored are not lost if the power is removed from the Controller.

You can restore the EEPROM contents to the Telstra default settings by selecting the "Load Parameters" function. Refer to Section 2.11.1, "Local Functions".

A list of the address locations and description of the variables stored are shown in the non-volatile Memory Parameters table in the pages below. (a quick reference chart is provided in Appendix F)

Note: Any codes not mentioned below are reserved and should not be changed.

Address	Function	Description
0-7	Serial number	Not adjustable.
8	Hardware configuration	Refer to Section 2.11.5 "Hardware Configurations"
9	Ident code	Refer to Section 2.9 "Changing the Ident Code"
10	Point to Point configuration	Refer to Section 2.9 "Changing the Ident Code"
11-18	Password	Factory default password is TELSTRA.
19-20	Micro-controller idle time	The rate the micro-controller inputs are scanned when the Hawk is asleep. <u>19 Default</u> = 246 (2.5 ms). <u>20 Default</u> = 0
21	Receiver on time	The period the receiver is powered when a Hawk Terminal is in cycling mode. Multiply the figure by the micro-controller idle time (19-20 above) to obtain the receiver on time in ms. <u>Default</u> = 60 (150 ms).
22	Receive total cycle time	The sum of the receiver on and off times. Multiply the figure by the micro-controller idle time (19-20 above) to get the true time in ms. <u>Default</u> = 240 (600 ms).
23	Identify timeout time	The true time period in ms that the Hawk will attempt to identify the input that woke it. <u>Default</u> = 50 (50 ms).
24	Maximum link establishment time	Sets the maximum time to establish a link, after which the Hawk will go to sleep. Divide the figure at this address by 10 to obtain the true time in seconds. <u>Default</u> = 32 (3.2 Seconds).

Address	Function	Description
25	Maximum allowable signal dropout time	A signal dropout of longer than this time will result in a dropped call (refer to 26 RSSI cut-off below). Divide the figure by 20 to obtain the true figure in seconds. <u>Default</u> = 100 (5 Seconds).
26	RSSI cut-off ¹	This is the level where signal dropout occurs. At this point, the receiver is muted and the signal dropout time (25 above) is started. This figure is <u>directly</u> related to the figure on the LCD in the RSSI meter position. <u>Default</u> (varies per module, measured for an input level of -100 dBm). See footnote below
27	DSP power on time	The period the system waits for the DSP to power on after commencing operation. <u>Default</u> = 50 (50 ms).
29	Rx mute time ²	The time the receiver mute remains open after the loss of M or E wire. Multiply this number by 5 Seconds. Values between 1 (5 seconds) and 254 (1270 seconds) are acceptable. If the number is 255, the default time of 750mS is used. If the number is 0, the receiver will never mute, i.e. infinite hold-up time. <u>Default</u> = 255 (750 ms).
30	Tx hold time ²	The time the transmitter remains active after the loss of M or E wire. Multiply this number by 5 Seconds. Values between 1 (5 seconds) and 254 (1270 seconds) are acceptable. If the number is 255, the default time of 630mS is used. If the number is 0, the transmitter will never turn off. <u>Default</u> = 255 (630 ms).
31-32	Modem access	Refer to Section 2.11.6 "Wake Up Sequence" <u>31 Default</u> = 65 (AAA). <u>32 Default</u> = 5 (5 Seconds)

¹ The RSSI cut-off figure is PRE-SET during factory testing for an Rx input level of -100 dBm. The resulting figure present in the RSSI meter reading 'r0' (refer to Section 2.6.4) is entered into Address 26. Any subsequent reduction in the RSSI level will mute the Receiver and start the signal dropout time.

² Addresses 29 & 30 MUST be set for the same value to avoid problems.

Address	Function	Description
33	Diagnostic Hold Up Time	The time the Hawk remains active for diagnostics after the last key press. Multiply this number by 10s. Values between 3 and 254 are acceptable. <u>Default</u> = 12 (120 Seconds).
35	Calling Line Identity	Allows the Hawk to carry CLI information in either DTMF or FSK format from the Exchange to the Customer Terminal. The value <u>must</u> be the same at each Terminal. A value of 255 will <u>disable</u> the function <u>Default</u> = 250 (enabled).
37	Link Check	A feature of the Exchange Terminal <u>only</u> to check the Hawk Link after a pre-set period without operation (i.e no telephone or data traffic) Once the Link is established, RSSI and Link ID are checked. If out of specification, a relay will close on the Alarm Port (SK105, refer to Section 2.2.9) The time period between alarm checks may be altered by entering a number between 10 and 254 (255 = <u>disabled</u>) Each digit represents 1 minute (ie a setting of 30 would result in a check every 30 minutes) <u>Exchange Default</u> = 240 (4 Hours). <u>Customer Default</u> = 255 (Disabled, no check).
40	Customer Terminal Minimum Dial Break	Minimum dial break accepted (a shorter break would accept switch bounce). Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 9 (45 ms)
41	Customer Terminal Maximum Dial Break	Maximum dial break accepted (longer breaks are switch-hook flashes). Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 18 (90 ms)
42	Customer Terminal Minimum interdigit pause	Minimum interdigit pause accepted. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 30 (150 ms)

Address	Function	Description
43	Customer Terminal Maximum switch-hook flash	Maximum switch-hook flash accepted. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 50 (250 ms)
44	Payphone Hold Up Time	The time the Hawk Link will listen for late payphone meter pulses after the call has been terminated. The value <u>must</u> be the same at each Terminal. Multiply the figure by 5 to obtain the true time in ms. <u>Default</u> = 50 (250 ms)
50	Exchange Terminal Flash-hook Duration	Duration of the generated flash-hook. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 20 (100 ms)
51	Exchange Terminal Dial Break Duration	Duration of the generated dial break. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 13 (65 ms)
52	Exchange Terminal Dial Make Duration	Duration of the generated dial make. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 7 (35 ms)
53	Exchange Terminal interdigit pause	Duration of the generated inter-digit pause when using a decadic phone. Multiply the figure by 5 to obtain the true time in ms <u>Default</u> = 120 (600 ms)
54	Exchange Terminal Ring Time-out	Maximum time between rings after which the Link will go to sleep, unless the Customer Terminal is off-hook. Multiply the figure by 50 to obtain the true time in ms <u>Default</u> = 105 (5.25 Seconds)
58	Telstra Default Parameters	Telstra <u>default</u> parameters are enabled via this location. (refer to Section 2.11.1) <u>Default</u> = 0 (Telstra parameters enabled)

2.11.4 Procedure to check or change the Address value(s)

The procedure below can be used to check or change the value present at any of the Address location shown above.

Step	Action
1	Press any key on the PC or VDT if the screen is blank. This activates the Terminal and display instructions for the wake-up sequence. The <u>Default</u> instruction is for the operator to enter the 'A' key three times.
2	Press "N" on the keypad until the screen displays "Force a Link" (This establishes a Link without requiring the correct Ident Code).
3	Press "Enter". The Terminal will power up and the display will change to show the other terminal's ident code. Press any key to continue. (This completes the set-up of a Test Link, allowing system parameters to be viewed and altered at the <u>Remote</u> Terminal)
4	Press "N" on the keypad until the screen displays "Alt L.Sys Param". Press "Enter" and the prompt "Enter Password" is displayed. Key in the password (default is TELSTRA) and press "Enter"
5	The screen will display "Location 008". Enter the Address of the parameter to be changed (from the table above) and then press "Enter". The current value of the specific address will be displayed.
6	If a change is necessary, key in the required value and press "Enter" to replace the current value. The screen will revert to "Alt L.Sys Param". Repeat steps 4 to 6 as necessary for any further address locations. This completes the value change(s) for the <u>Local</u> Terminal.
7	If it is necessary to check or change any address values for the <u>Remote</u> Terminal, refer to steps 8 and 9 below. Otherwise, refer to steps 10 and 11 below to complete the process without affecting the Remote Terminal.
8	Press "N" on the keypad until the screen displays "Alt R.Sys Param". Press "Enter" and the prompt "Enter Password" is displayed. Key in the password (default is TELSTRA) and press "Enter"
9	Repeat Steps 5 and 6 above as necessary to complete all value change(s) for the <u>Remote</u> Terminal
10	Once all necessary checks or changes are performed for each Terminal, press "Q" on the keypad until the screen displays "Cleardown Link" Press "Enter" to turn off the test link.
11	Press "P" to step back through the menu until it shows "Go to sleep" and press "Enter" to turn off the local controller.

2.11.5 Hardware Configurations (Address 8)

The Hardware Configuration Byte controls receiver cycling, the disabling of alarm tones, and whether a payphone is fitted to the Hawk link. The functions are enabled when the associated bits of the Hardware Configuration byte are set.

The following table shows the relationship between the bits and the functions that they enable.

Bit	Function
4	Exchange Terminal receiver cycles when idle.
8	Customer Terminal receiver cycles when idle.
64	Alarm tones disabled.
128	Payphone fitted.

The bits are not set individually; instead, the values of the bits required to be set are added together. For example, for a link with Exchange Terminal receiver cycling, alarm tones disabled and payphone fitted the value of the byte = 196 (4 + 64 + 128). This number is then input against Address 8 to set the configuration.

Note: The Hardware Configuration Byte must be set to the same value at both Terminals.

Refer to Section 2.11.4 to check or change the value present in Address 8 as necessary.

2.11.6 Wake Up Sequence (Addresses 31 & 32)

A special wake up sequence is used when a modem is connected to the Controller's RS232 port. This prevents modem shut-down from inadvertently waking up the Hawk.

When accessing the Controller with a Laptop PC or VDT, a series of three key presses (after button wakeup) within a defined time is required; otherwise, the Hawk will shut down. The required key and acceptance time is user defined in Addresses 31 and 32.

The value stored at address 31 defines an ASCII character for the key press required to wake up the Hawk. The ASCII character set is contained in Appendix E of this manual. Values between 32 (space) and 126 (~) may be used. If 255 is stored at this location the function is disabled.

The value stored at address 32 defines the period (in seconds) that the three key presses must be within. The number at this address must not be less than two.

Example: If address 31 contains 65 and address 32 contains 5, then the character 'A' (from the ASCII table) must be pressed three times within 5 seconds (after button wakeup) for the Hawk to wake up.

Refer to Section 2.11.4 to check or change the value present in Addresses 31 and 32 as necessary.

3

Installation of the Terminal

3.1 General

The Hawk Terminal has four mounting brackets to attach the chassis either:

- > Directly to a wall,
- > To the 19" Rack Mount Shelf Kit
- > To the 12U 19" Mounting Plate,

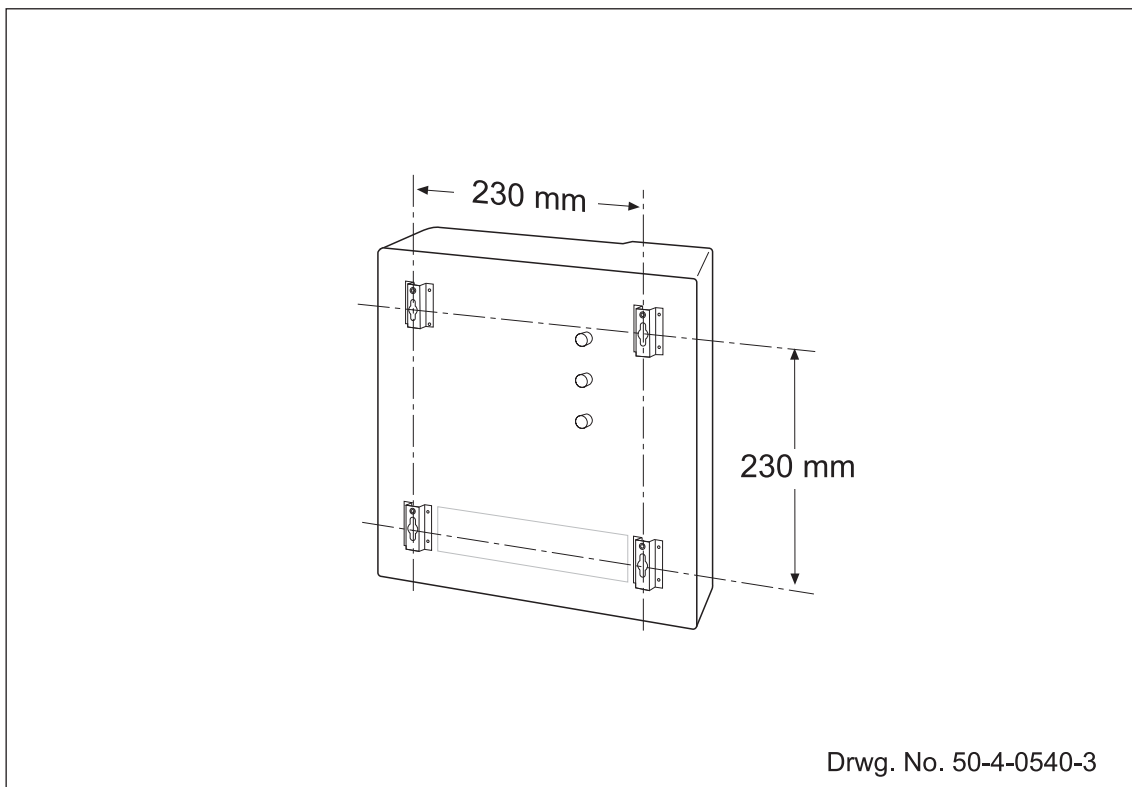


Figure 3.1: Wallmount Terminal Mounting Brackets

3.1.1 General Installation Points

When deciding on the position of the Terminal, the following general points should be considered wherever practicable.

- > The length of coaxial cable between the Terminal and the antenna should be as short as possible, and should preferably not exceed 25 metres,
- > The Terminal requires access to a good earth (separate to mains earth),
- > The wires to the Terminal from its power source, and any other equipment it is attached to, should be kept as short as possible,
- > There should be enough room around the Terminal to enable installation and any subsequent servicing to be easily performed.

3.2 Installation Tools

Although each specific installation may warrant the use of different tools or equipment, the list below details a suggested minimum requirement.

- > Electric/battery-powered drill with 3.5 mm diameter bit,
- > Screwdriver with inter-changeable tips.
- > small adjustable Wrench
- > Miscellaneous tools (side-cutters, pliers, razor cutter etc)

3.3 Attaching the Terminal to a Wall

As well as considering the general installation points detailed in Section 3.1.1, it should be noted that the Terminal should be mounted at least 300mm above the floor and also at least 230mm from any corner junction (refer to Figure 3.2)

A drilling template is provided in Appendix C, this can be used to attach the Terminal to the wall as follows:

- 1 Lay the drilling template flat against the wall, in the position you intend to attach the Terminal. Mark the centres of each circle on the template onto the wall.
- 2 Using a drill with a 3.5-mm diameter bit, drill a 20-mm deep hole at each of the positions marked in point (1) above.
- 3 Insert the four wood screws supplied with the Terminal into the holes. Drive each screw into the wall, until the space between the wall and the head of the screw is approximately 5 mm
4. Mount the Terminal on the wall by slotting the screw heads into the four mounting brackets.

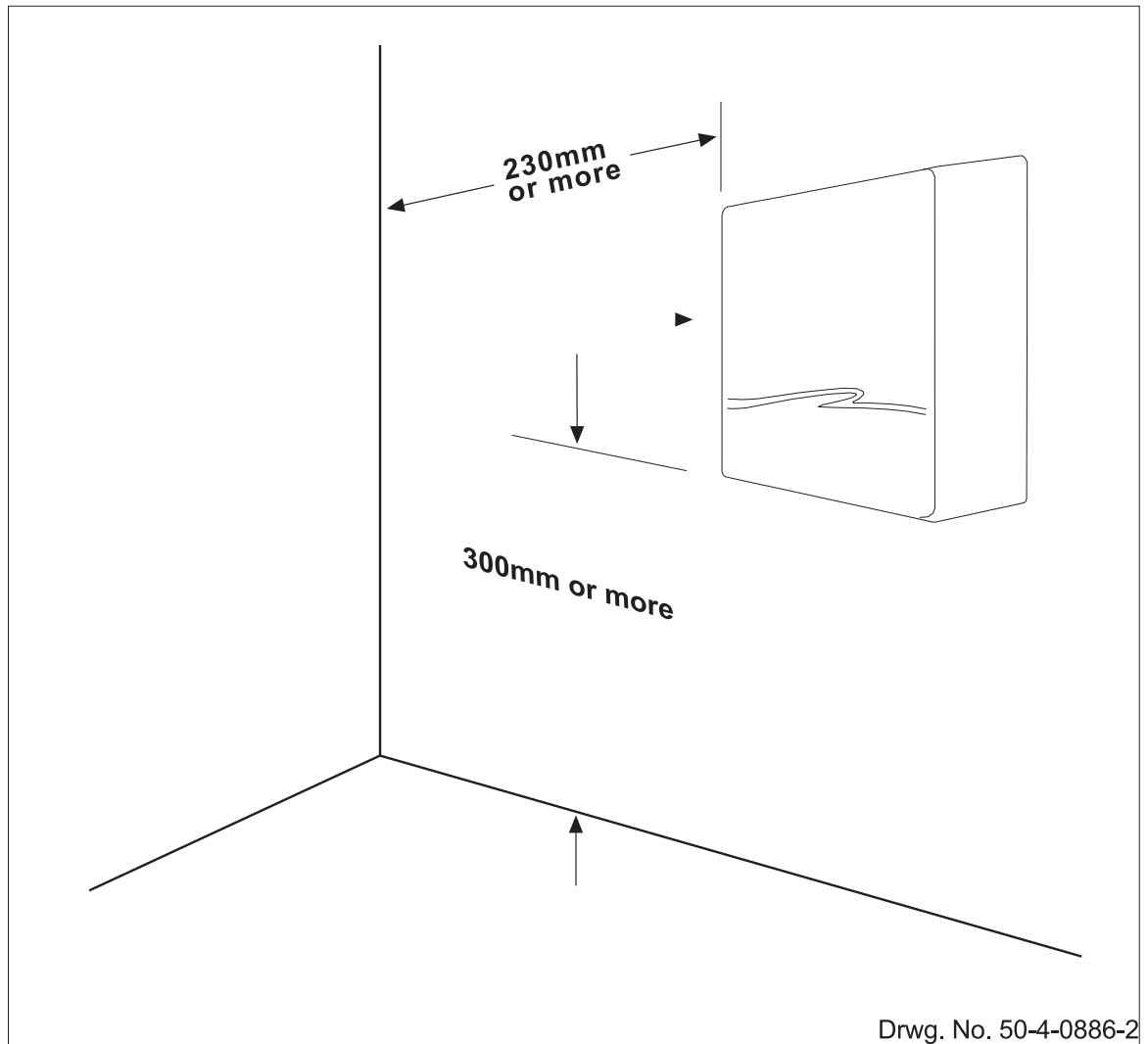


Figure 3.2: Suggested Terminal position when wall mounting

3.4 Mounting the Terminal in the 19" Rack Mount Shelf Kit¹

The 19" Rack Shelf Mounting Kit is used when it is required to fit a Hawk wall mount Terminal into an industry standard 19" equipment rack.

The Mounting Kit has been designed to provide easy mounting of the Hawk wall mount Terminal and associated DC-DC Converter module (if required) prior to installation within the equipment rack. It can be installed in different positions with respect to the equipment rack (via the adjustable location of the left-hand and right-hand brackets, refer Section 3.4.2)

¹ Note that Section 3.4 is a copy of the Assembly Instructions provided with the Kit.

3.4.1 Material Contents of Mounting Kit

The Mounting Kit is provided on a cardboard tray sealed with clear-film heatshrink and contains the following items:

Item	Description	Qty Supplied
A	19" Rack Shelf Tray	1
B	Left-hand Bracket	1
C	Right-hand Bracket	1
D	DC-DC Converter Bracket ¹	2
E	Shoulder Screw	6
F	M5 Hex Head Stainless Steel set screw	6
G	M5 Fan Disk Stainless Steel lock washer	6
H	M5 Plain Stainless Steel washer	12
I	M6 Cage Nut	4
J	M6 Steel Slotted Pan Head screw	4
K	M6 Stainless Steel washer	4
L	Assembly instructions (this document)	1

3.4.2 Assembly Instructions

The following sections detail the assembly of the Mounting Kit, installation into the 19" equipment rack and fitting of the Hawk Terminal and optional DC -DC Converter module.

Refer as necessary to Section 3.4.1 (Material Contents) and to Figure 3.3.

Tools required

- > Small adjustable Wrench,
- > Suitable flat-blade screwdriver

¹ Note that each bracket is to be attached to the DC-DC Converter module via the 4x screws that are supplied with the module as part of the Wall Mounting Plate - they are not included as part of this Kit. Remove the Mounting Plate and re-use the screws as required.

Procedure

- 1) As the 19" Rack Shelf Tray (refer Item A in Section 3.4.1) can be installed in different positions with respect to the 19" equipment rack (via the adjustable location of the left-hand and right-hand brackets) it is first necessary to determine the desired mounting position prior to attachment of the brackets.

Each left-hand and right-hand bracket (refer Items B and C in Section 3.4.1) should then be attached to the 19" Rack Shelf Tray via 3x M5 set screws, lock washers and plain washers (refer Items F, G and H of Section 3.4.1).

Ensure that the plain washer (Item H) is positioned against the bracket, with the lock washer (Item G) then positioned between the plain washer and the set screw.

- 2) The Hawk wall mount Terminal and associated DC-DC Converter module (if required) are fitted to the 19" Rack Shelf Tray via 6x shoulder screws and washers (refer Items E and H in Section 3.4.1). Fit all screws/washers as necessary.
- 3) If required, attach each bracket (refer Item D in Section 3.4.1) to the DC-DC Converter module via the 4x screws provided with the module.
- 4) Fit 4x M6 cage nuts (refer Item I in Section 3.4.1) into the desired positions in the 19" equipment rack.



The Shelf should be mounted in the horizontal plane; there should be a gap of at least 2U between the top and bottom of the Shelf and any other equipment contained within the rack to promote efficient airflow.

Unsuitable installation could result in reduced product lifetime and may void warranty.

- 5) Fit the assembled Rack Shelf into the 19" equipment shelf via the 4x M6 Slotted Pan Head screws and washers (Items J and K of Section 3.4.1) Ensure all screws are securely tightened.
- 6) Fit the Hawk Terminal and DC-DC Converter module to the Tray, via the 6x shoulder screws attached in Step 2) of this instruction. Secure each item by ensuring that the screw-heads are correctly located within the 'keyholes' in the Terminal and Brackets .

Note that the Hawk terminal and DC-DC Converter module can be attached to the Tray prior to installation within the 19" equipment rack but the weight of the equipment should be considered (especially if positioning above shoulder-height)

- 7) Connect all necessary cables to the equipment, routing and securing as required.

Note that the Tray has pre-drilled holes in the front and rear to allow use of cable ties etc to secure any cables.

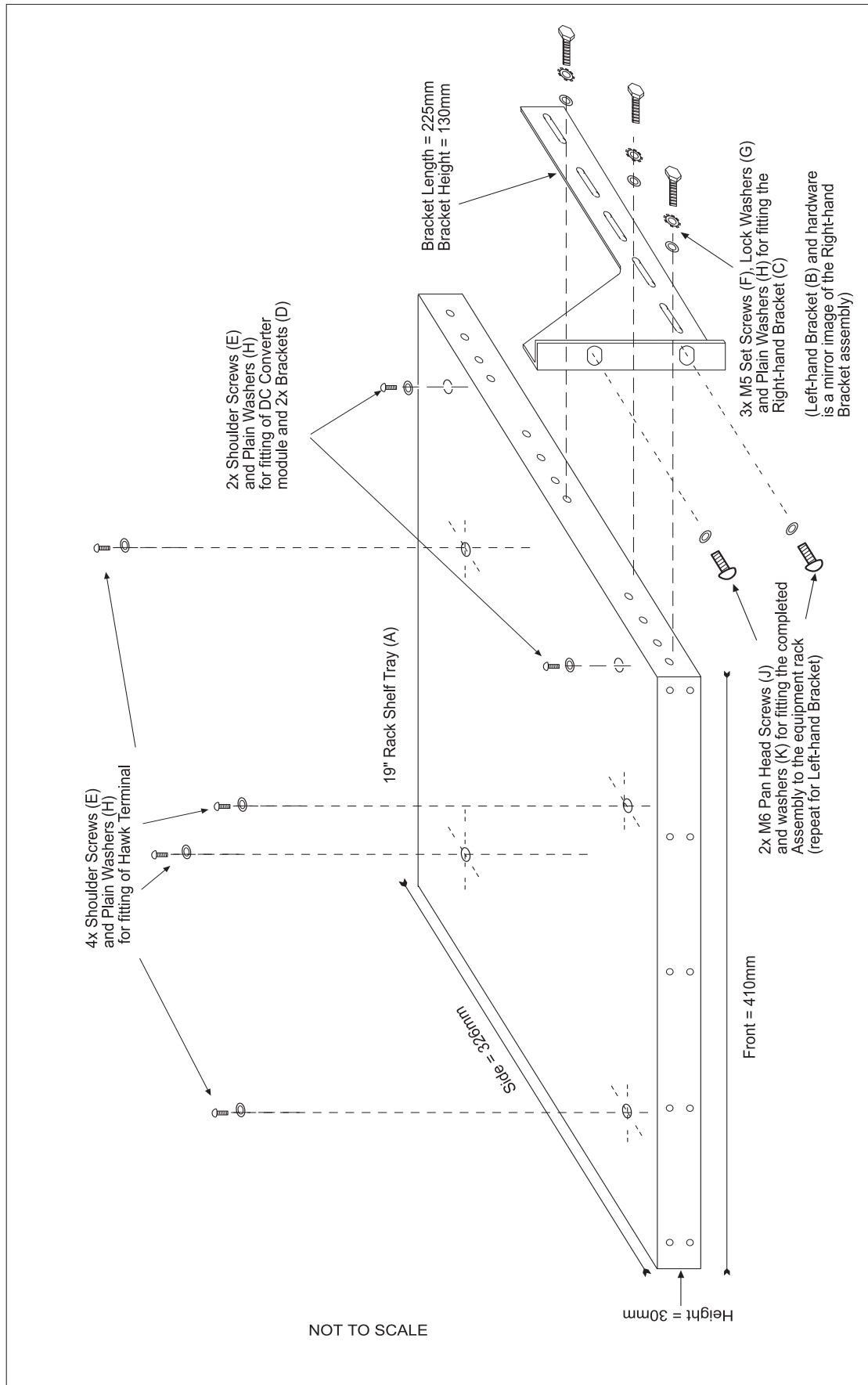


Figure 3.3: Assembly of the 19" Rack Shelf Mounting Kit
(DC-DC Converter module brackets are Not Shown)

3.5 Attaching the Terminal onto the 12U 19" Mounting Plate

The 12U Mounting Plate allows a Hawk wall mount Terminal to be mounted to the front of an industry standard 19-inch rack system. This allows maximum use of the available space in the rack system.

The plate occupies 12U of vertical space (one U = 44.5 mm or 1 ¾ inch) providing sufficient area to allow the mounting of the Hawk wall mount Terminal, a DC-DC Converter module and a Krone block (not supplied).

3.5.1 Fixing the Terminal, DC-DC Converter and Krone block to the Plate

The Terminal, DC-DC Converter module and Krone block can be attached as required to the plate as shown in Figure 3.4.

- > The Terminal and DC-DC Converter module are attached via the 6x shoulder screws and M5 washers supplied (refer to 'dotted' holes in Figure 3.4),
- > The Krone block can be attached via the 2x M5 pan-head screws and washers supplied (refer to Figure 3.4 for Krone block mounting position)

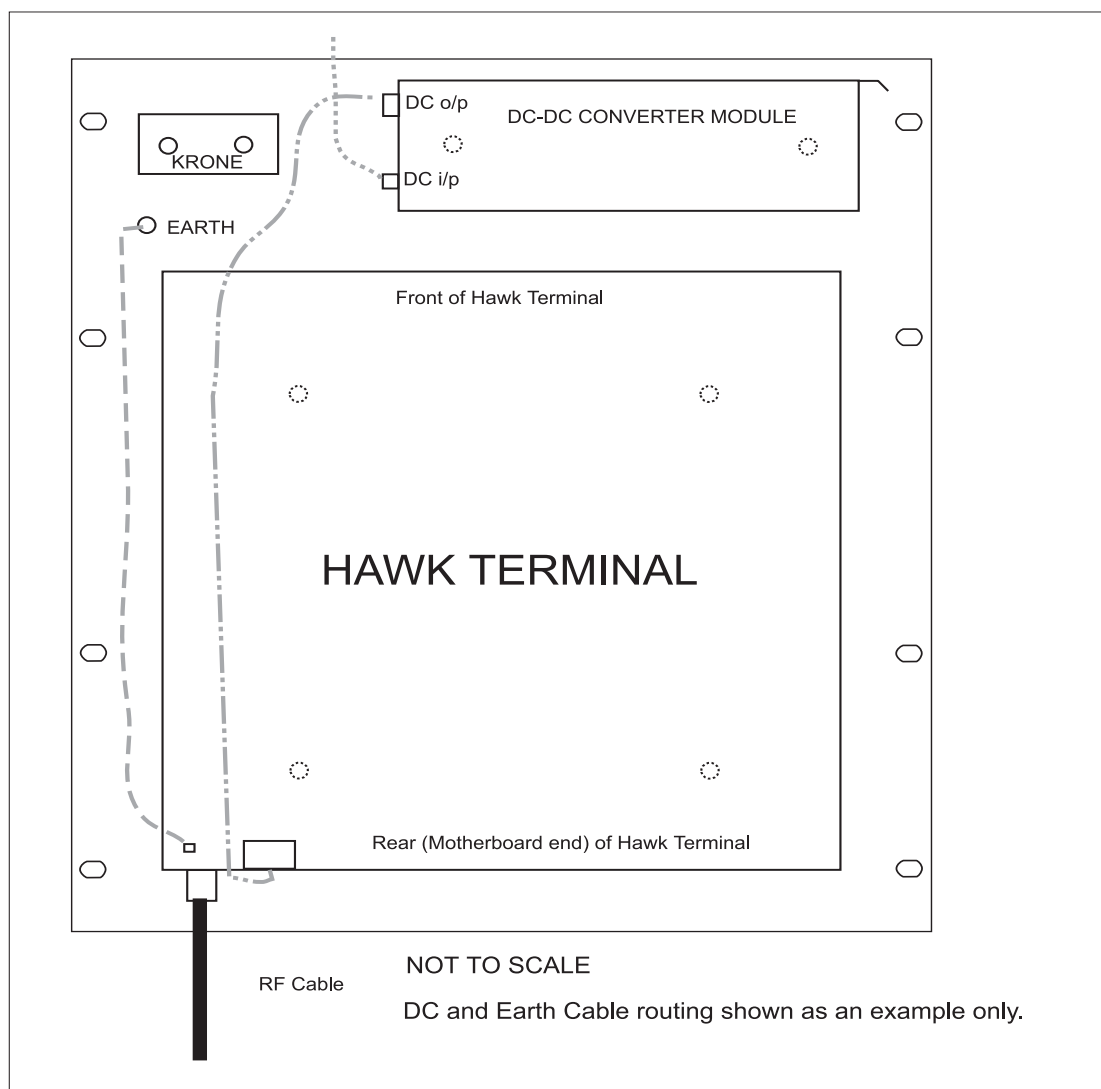


Figure 3.4: Installation of the Hawk Terminal and accessories onto the 12U Mounting Plate

3.5.2 Fixing the Plate to the 19" Rack System

The Plate is attached to the 19" Rack System via the 'slotted' holes shown in Figure 3.4, using eight x M6 Screws/washers (not provided)

3.6 Connection of Cables

The Hawk has seven plugs on the rear of the chassis that allow connection of various cable types, depending on requirements.

Most cables are common to each Terminal; some are specific to a particular usage.

Refer to Figure 3.5 for plug descriptions and locations and to Sections 3.6.3 to 3.6.10 for details of connector pin-outs; wire colours etc.

3.6.1 Common Cables

The following cables should be connected at each Terminal:

- > Telephone line cables,
- > Power supply cable,
- > Antenna cable,
- > Earth cable

3.6.2 Other Cables

There are several cables that are specific to a particular usage (the cables can be ordered independently or within the optional Auxiliary Package)

- > Link Fail Alarm cable,
- > Datagate/modem cable,
- > Antenna Cable Tail,

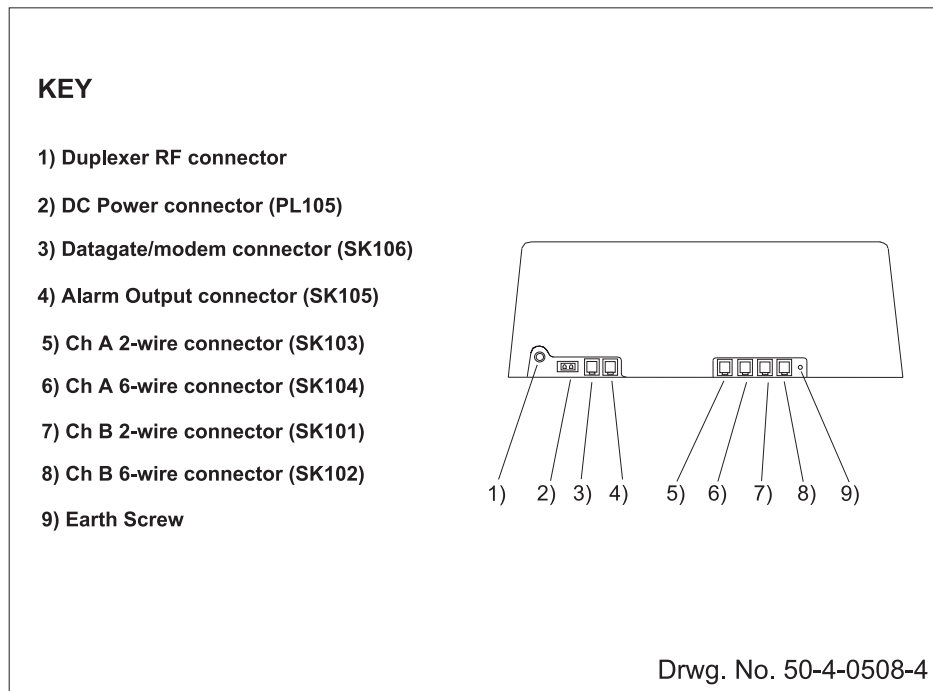


Figure 3.5: Rear Panel Connectors

3.6.3 Telephone Line connections (SK101 to SK104)

There are four RJ11 sockets that provide either a 2-wire or 6-wire (4-wire + E & M) connection to Channel A and Channel B as required.

Each terminal is supplied with two cables that can be used for 2-wire or 6-wire connections as required. An RJ-11 connector is shown in Figure 3.6, with the connector pin-outs identified in Table 3.1 (2-wire) and Table 3.2 (6-wire).

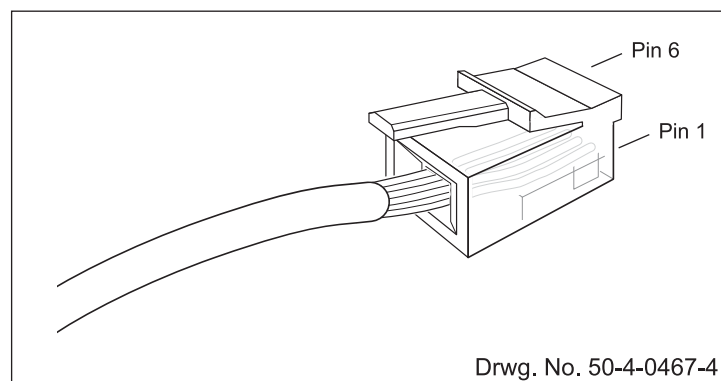


Figure 3.6: RJ11 Connector for 2-wire or 6-wire Socket

2-wire Connection

SK103 (Channel A) and SK101 (Channel B) provide a 2-wire connection.

Pin	Signal	Wire Colour
1	Not connected	Blue
2 ¹	-ve Leg	Brown
3 ¹	Not connected	Brown/White
4 ¹	Not connected	Green/White
5 ¹	+ve Leg	Orange/White
6	Not connected	Blue/White

Table 3.1: RJ-11 Pin-out's and colour coding for 2-wire connection

To use the Exicom supplied cable for a 2-wire connection; proceed as follows:

- 1 Strip the outer jacket of the un-terminated end of the cable to expose the six coloured wires,
- 2 The BLUE, BROWN/WHITE, GREEN/WHITE and BLUE/WHITE wires are not required for 2-wire connection. They should be completely cut back. Strip and bare the ends of the remaining wires,
- 3 Repeat for the second cable (if 2-wire operation is required) and plug each cable into the appropriate Channel A or Channel B 2-wire socket on the terminal.

4-wire + E and M connections

SK104 (Channel A) and SK102 (Channel B) provide a 4-wire + E and M connection.

Pin	Signal	Wire Colour
1	M-wire	Blue
2	Tx audio	Brown
3	Tx audio	Brown/White
4	Rx audio	Green/White
5	Rx audio	Orange/White
6	E-wire	Blue/White

Table 3.2: RJ-11 Pin-out's and colour coding for 6-wire connection

¹ Note that for 2-wire connectors SK101 and SK103 ONLY, pins 2/3 (-ve leg) and 4/5 (+ve leg) are physically connected on the Motherboard PCB. Therefore, pins 3 and 4 are not required for use.

To use the Exicom supplied cable for a 6-wire connection; proceed as follows:

- 1 Strip the outer jacket of the un-terminated end of the cable to expose the six coloured wires,
- 2 Strip and bare the ends of all wires; connect each wire to the equipment using the terminal as detailed in Table 3.2,
- 3 Repeat for the second cable (if 6-wire operation is required) and plug each cable into the appropriate Channel A or Channel B 6-wire socket on the terminal.

3.6.4 Power Supply connection (PL105)

A DC power supply can be connected to the terminal via PL105.

Note: The Hawk terminal must operate from a DC supply within the range 10.8 VDC to 15.5 VDC (13.8 VDC nominal level) using a negative ground

A radio power cable is provided with each Terminal, as shown in Figure 3.7.

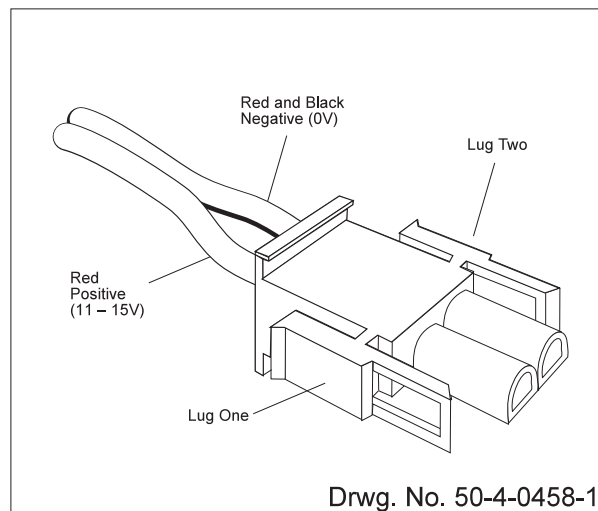


Figure 3.7: Connector for the Power Supply Socket¹

Connection via a DC source

A suitable DC power supply can be directly connected via the supplied cable.

Connection via the Type 2461 DC-DC Converter module

The *output* of the Type 2461 DC-DC Converter module can be connected to the Hawk terminal via the supplied cable.

Note: The *input* to the Converter module can be within the range 22 VDC to 60 VDC with either a positive or a negative ground. The *output* provides a nominal 13.5 VDC output with a negative ground.

¹ This connector is captive when inserted into the socket. To extract the connector, first push it fully home then press the two Lugs together while pulling the plug and cable out of the socket.

3.6.5 Antenna connection

The Type 2824 Duplexer module has a Female N-type connector at its antenna port for connection to the antenna, cable and associated lightning arrester.

The use of high quality, 50-Ohm coaxial cable (minimum type RG213 or equivalent) is recommended.

Note: The total length of coaxial cable between the antenna and the terminal, including the cabling to any lightning arrester, should be kept as short as practical to minimise transmission loss.

Ensure any connectors exposed to the weather are adequately protected with suitable weatherproof tape that completely seals the connector from external moisture.

Internal Antenna Cable Tail

If the Hawk terminal is to be mounted within a Cabinet, a separate cable (the Antenna Cable Tail) is available to connect the antenna port on the Type 2824 Duplexer module to the exterior of a typical Cabinet.

This allows external connection of the lightning arrester and antenna, via suitable cables and connectors; without accessing the interior of the Cabinet.

Note: The Antenna Cable Tail consists of a 1.25m length of RG213 cable with a Male N-type connector at each end.

3.6.6 Earth connection

The provision of a suitable earth for the terminal is the responsibility of the installer and is essential as a safety measure to protect the radio equipment from lightning induced transient voltage discharges.

Note: The transient voltage protection devices provided on the 2-wire lines and coaxial cable cannot function without an adequate earth connection

Earth Cable

An Earth Cable with an M3 lug at one end should be connected to the terminal via the earth screw on the rear of the chassis (refer to Figure 3.5) with the other end connected as necessary to the equipment rack, 12U plate or cabinet etc.

This should prevent damage to the terminal from lightning strikes, particularly strikes to the telephone cables. (Installation of the lightning arrester may provide protection from strikes to the antenna system)

Figure 3.8 shows the connection of the Earth Cable to the terminal Earth Screw.

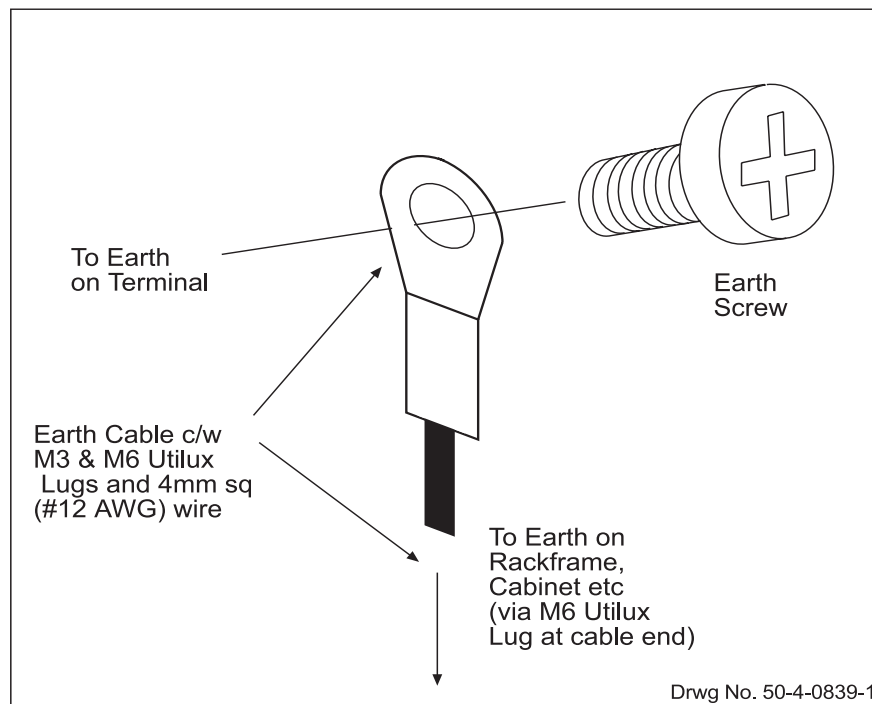


Figure 3.8: Connection to Earth Screw

3.6.7 Link Fail Alarm connection (SK105)

Relay RL101 is located on the motherboard PCB and is controlled via software within the type 8080 Controller module (when configured for Telephone Mode ONLY)

The software allows the integrity of the radio link to be checked; the relay will operate if the integrity check fails, providing an external output via an RJ45 socket (SK105) as shown in Figure 3.9 below.

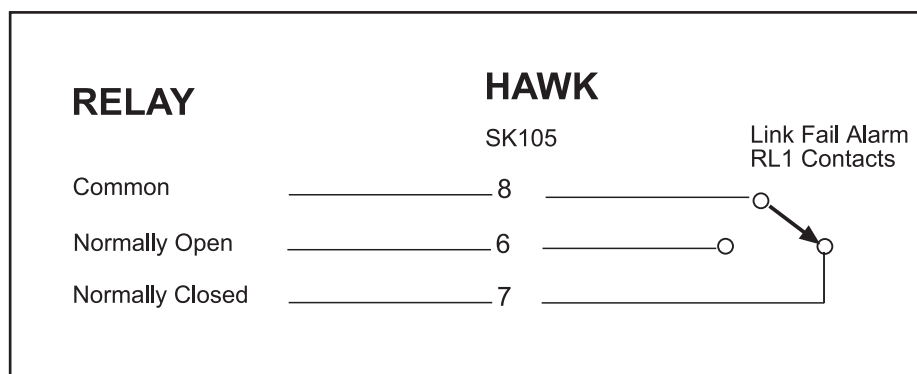


Figure 3.9: Operation of Link Fail Alarm Relay RL101

Note: Although each Terminal is fitted with the Relay and SK105, only the Exchange Terminal will use or access the Link Fail Alarm.

A Link Fail Alarm Cable can be supplied, wired as shown in Figure 3.10, with the connector pin-outs identified in Table 3.3.

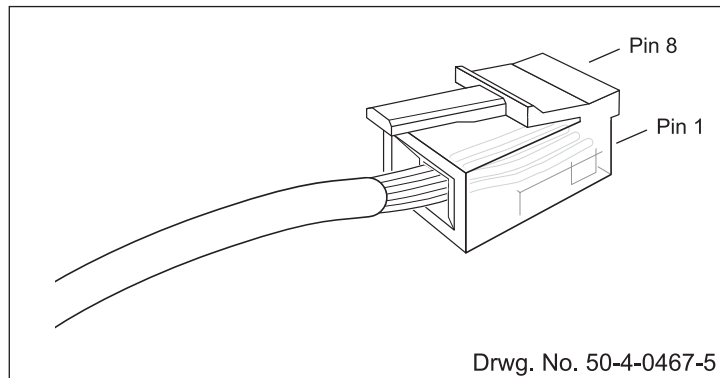


Figure 3.10: RJ45 Connector for Alarm Output Socket

Pin	Signal	Wire Colour
1	Not connected	Green
2	Not connected	Orange
3	Not connected	Blue
4	Not connected	Brown
5	Not connected	Brown/White
6	RL1A pin 3 (normally open)	Green/White
7	RL1A pin 2 (normally closed)	Orange/White
8	Common	Blue/White

Table 3.3: RJ-45 Pin-out's and colour coding for Alarm Cable connection

3.6.8 Datagate/modem connection (SK106)

The type 8080 Controller module has an RS232 port that allows remote access of various diagnostic and configuration parameters via the use of a suitable Windows-based program (such as HyperTerminal etc)

There are two cables that can be supplied to connect to SK106 as follows:

3.6.9 Datagate/Modem to Hawk Controller Cable

A Datagate to Hawk Controller Cable (RJ45 to DB25) can be supplied, wired as shown in Figure 3.11, with the connector pin-outs identified in Table 3.4.

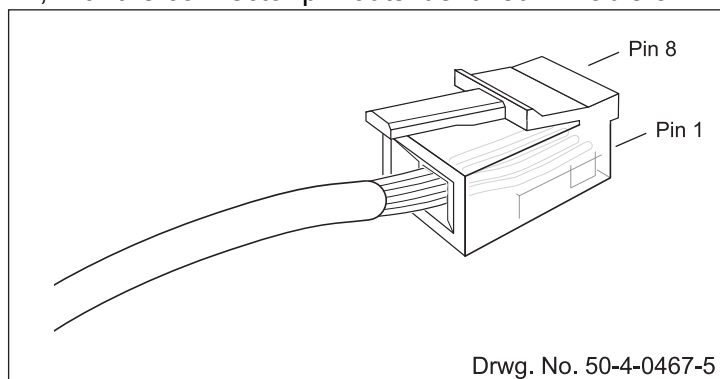


Figure 3.11: RJ45 Connector for Datagate/modem connection

RJ45 connector Pin#	Signal present at RJ45 Connector Pin	Wire Colour	DB25 Plug Pin#
1	Ground	Green	1
2	-	Orange	9
3	-	Blue	20
4	TxD	Brown	2
5	RxD	Brown/White	3
6	-	Green/White	6
7	+5V Out	Orange/White	Not Connected
8	Ground	Blue/White	7

Table 3.4: RJ-45 Pin-out's and colour coding for Datagate/modem cable connection



Pin 7 of the RJ45 connector supplies +5V. This pin must be left **unconnected** (as shown) if the Hawk is to be used with an ASCII dumb terminal or Laptop PC etc.

3.6.10 PC to Hawk Controller Cable

A PC to Hawk Controller Cable can be supplied, wired as shown in Figure 3.12, with the connector pin-outs identified in Table 3.5.

This cable can be used in place of the Datagate/Modem to Hawk Controller Cable to allow connection of a laptop PC etc.

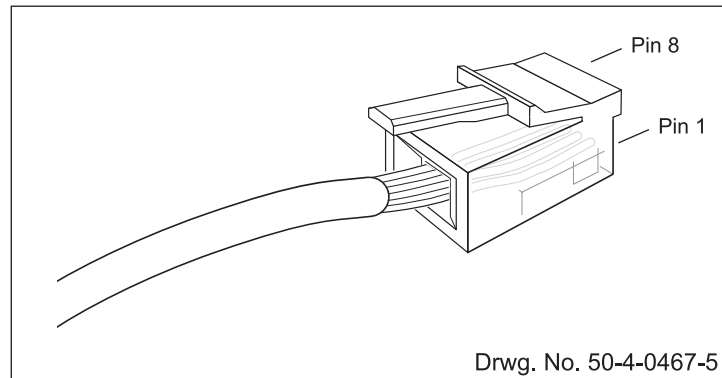


Figure 3.12: RJ45 Connector for PC Cable connection

RJ45 connector Pin#	Signal present at RJ45 Connector Pin	DB9 Socket Pin#	Wire Colour
4	TxD	2	Brown
5	RxD	3	Brown/White
8	Ground	5	Blue/White

Table 3.5: RJ-45 Pin-out's and colour coding for PC Cable connection



CAUTION

Pin 7 of the RJ45 connector supplies +5V. This pin must be left **unconnected** if the Hawk is to be used with an ASCII dumb terminal or Laptop PC etc.

3.6.11 Antenna Cable Tail

Refer to Section 3.6.5 for details regarding the use of the Antenna Cable Tail when installing a Terminal into a typical Telstra Cabinet.

3.7 Initial DC power testing of each Terminal

After connection of the 'common' cables (telephone, DC power, Antenna and earth) for each Terminal, it is recommended that DC power be applied to check the initial operation of each Terminal in turn.

This will allow the installer to determine any immediate problems with the DC operation of the terminal, reducing the need for return visits to each terminal site.

Note: Refer to Section 3.9 for details regarding trial calls to verify operation of the entire radio link.

3.7.1 Exchange Terminal

When initially supplied with DC power, various module LED's are activated as described below:

Module Type	LED name	Status
Controller	"Active" LED	ON for a few seconds then remaining off until valid activation signal detected
Transmitter	"Power" LED	Continuously ON
Receiver	"Power" LED	Continuously ON

All other LED's should remain extinguished at this point.

- > If the LED's don't light as described, check all DC power supply connections. If there is still a problem, refer to Appendix B "Troubleshooting Guide".

3.7.2 Customer Terminal

When initially supplied with DC power, various module LED's are activated as described for the Exchange terminal above, with an operational change to the Receiver module LED.

Module Type	LED name	Status
Controller	"Active" LED	ON for a few seconds then remaining off until valid activation signal detected
Transmitter	"Power" LED	Continuously ON
Receiver	"Power" LED	Cycling ON/OFF (power saving mode)

All other LED's should remain extinguished at this point.

- > If the LED's don't light as described, check all DC power supply connections. If there is still a problem, refer to Appendix B "Troubleshooting Guide".

3.8 Final Antenna Alignment

The final antenna alignment procedure requires monitoring of the RSSI while adjusting the antenna. As such, it is best performed with two people, one to monitor and the other to rotate the antenna.

Note: A single person with a Laptop PC plugged into SK106 (Datagate/modem socket) of the Terminal could also perform the procedure if there is sufficient cable length to allow access to the antenna. Refer to Section 3.8.1 below.



Do not stand in front of the antenna, as intense electromagnetic radiation is hazardous to your health.

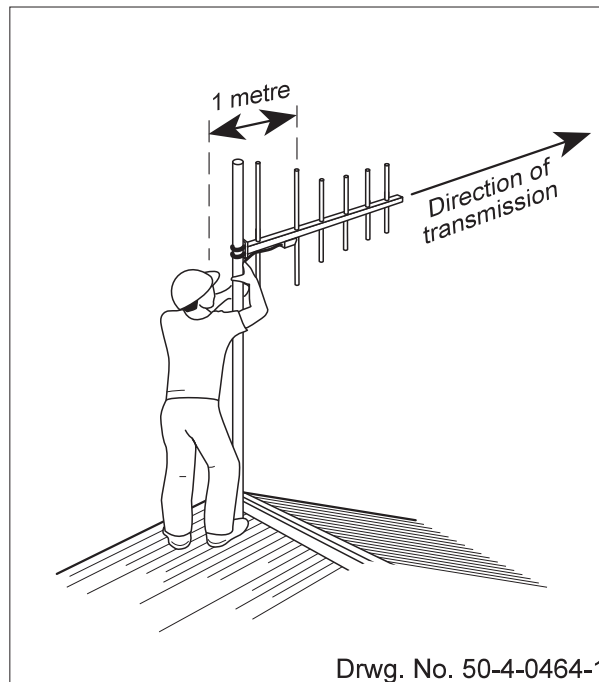


Figure 3.13: Antenna Alignment

3.8.1 Alignment Sequence

The procedure can be performed at each Terminal via the 8080 Controller front panel buttons and LCD or using a Laptop PC.



Please note that it is possible to lose contact with the remote terminal during this alignment process e.g. if the antenna is moved too far out of alignment. If the received signal strength drops below threshold level the Controller in the local terminal will drop out of the test link mode and will revert to F1 showing “error” on the display.

In this condition, the local terminal will not be able to re-establish contact with the remote terminal to turn it off manually. The remote terminal will then continue to transmit in “test” mode until its time out period has elapsed (10 minutes) After that both terminals will turn off and go to sleep.

Note: During this period it is still possible to continue to align the antenna provided the Controller display is scrolled back to the “0” position (RSSI level)

Procedure using the 8080 Controller module front panel buttons and LCD

Note: The following instructions assume that the Hawk terminal wall mount cover has already been removed and that all necessary cables are connected at each Terminal location.

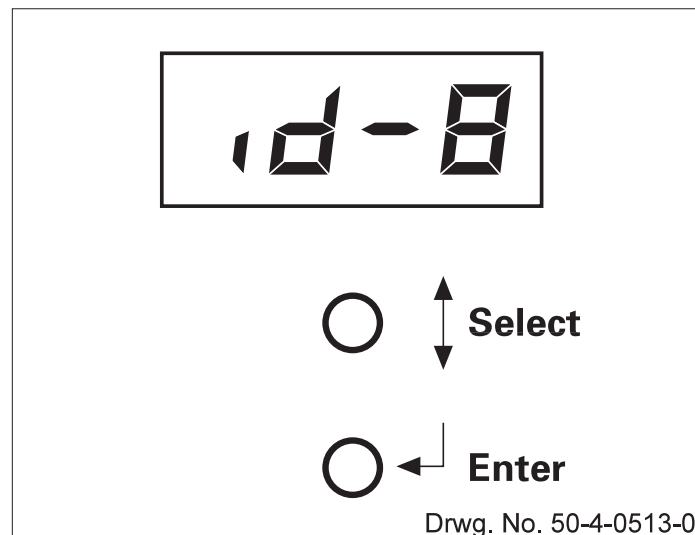


Figure 3.14: Controller front panel

Step	Action
1	Press the top button on the module if the LCD is blank. This activates the terminal. Continue to press the top button until the LCD displays “F0.—” (Force a Link – establishes a Link without requiring correct Ident Code).
2	Press the bottom button. The Terminal will power up and the “—” on the LCD display will change to show the other terminal's ident code. This completes the set-up of a Test Link.
3	Press the top button until “F3.—” is displayed. Press the bottom button and the “—” on the display will change to show a number representing the strength of the signal that the Hawk terminal is <u>receiving</u> . The higher the number, the better and stronger the signal is.
4	At this point, the Transmitter at the local Terminal will have <u>switched off</u> . Ensure that it is safe to touch the antenna by checking that only the bottom transmitter LED is glowing. (Note that the remote Terminal will continue transmitting for up to 10 minutes until the link “times out” or until the bottom button is pushed)
5	While observing the display, rotate the antenna until the display shows its highest value and then secure the antenna in place. (Note that the person turning the antenna should rotate it from behind, and stand <u>at least 1 metre clear</u> of the active element so as not to influence the readings, see Figure 3.13)
6	Press the bottom button on the controller front panel again, so that the display shows “F3.—”. Step back through the display by holding the top button down and then pressing the bottom once until it shows “F2”. Press the bottom button to turn off the test link.
7	Step back through the menu until it shows “OFF” and press the bottom button to turn off the local controller. This completes the Alignment Procedure, repeat for the other Terminal.

Procedure using a Laptop PC connected to socket SK106

It is possible to perform this procedure via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) to access information via the RJ45 socket SK106.

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.9 for pin-out details.

Step	Action
1	Press any key on the PC if the screen is blank. This activates the terminal. Follow the instructions that are displayed to access the software menu (<u>default</u> is to press the 'A' key three times).
2	Press "N" on the keypad until the screen displays "Force a Link" (This establishes a Link without requiring the correct Ident Code).
3	Press "Enter". The Terminal will power up and the display will change to show the other terminal's ident code. Press any key to continue. This completes the set-up of a Test Link.
4	Press "N" until "Anten Align --" is displayed. Press "Enter" and the display will change to show a number representing the strength of the signal that the Hawk terminal is <u>receiving</u> . The higher the number, the better and stronger the signal is.
5	At this point, the Transmitter at the local Terminal will have <u>switched off</u> . Ensure that it is safe to touch the antenna by checking that only the bottom transmitter LED is glowing. (Note that the remote Terminal will continue transmitting for up to 10 minutes until the link "times out" or until "Enter" is pushed)
6	While observing the display, rotate the antenna until the display shows its highest value and then secure the antenna in place. (Note that the person turning the antenna should rotate it from behind, and stand <u>at least 1 metre clear</u> of the active element so as not to influence the readings, see Figure 3.13)
7	Press "Enter" so that the display shows "Anten Align --". Step back through the display by pressing "P" until it shows "Cleardown Link". Press "Enter" to turn off the test link.
8	Press "Q" to display "Go to sleep" and press "Enter" to turn off the local controller. This completes the Alignment Procedure, repeat for the other Terminal.

3.9 Testing the Link

A test call should be performed on each channel after the correct installation of each terminal and associated cabling, antenna etc.

Ideally, a full test of the Hawk link will involve one person at each Terminal to allow traffic quality to be monitored as necessary.

The test call procedure will vary depending on the configuration of each Channel, i.e. Telephone or Point to Point.

3.9.1 Preparation

Prior to making a test call, ensure that the wall mount cover is removed (see Section 4.6); ensure that all cables are connected correctly (see Section 3.6) and that there is suitable DC power connected to the Hawk terminal.

Note: It is assumed that initial DC power testing (see Section 3.7) and Final Antenna Alignment (see Section 3.8) has already been performed for each terminal.

3.10 Brief overview – Telephone operation

When configured for Telephone operation, the Hawk link will respond to either of the following initiating conditions:

- > Incoming ringing to the Exchange Terminal or
- > Telephone off-hook at the Customer Terminal

Upon receipt of either condition, the Controller module at the initiating terminal will become active and begin the identification handshake procedure with the Controller module in the remote terminal.

This involves recognition and acknowledgement of the pre-determined Ident Code within both terminals.

Note: This handshake process occurs regardless of whether the initiating condition is present on Channel A or Channel B.

Once the handshake procedure is completed, the audio mute is opened and either:

- > Incoming ringing is forwarded, via out of band signalling tones, to the Customer Terminal, causing the telephone to ring or
- > Dial tone is heard via the telephone at the Customer Terminal, allowing DTMF tones to be sent to the Exchange Terminal via the audio path (or decadic dialling loop-breaks to be converted to BCD digits and sent to the Exchange Terminal via the out of band signalling tones)

Full duplex audio traffic (speech, fax or modem data) occurs once the telephone is answered either at the Customer Terminal or by the called party, continuing until the telephone is placed on hook at the Customer Terminal, causing the Link to shut down.

3.10.1 Test Call originating from the Exchange Terminal

Connect a test telephone to the appropriate Channel A socket on the Exchange Terminal, dial the number for the telephone connected to Channel A of the Customer Terminal and confirm that:

- > Ringing can be heard in the test telephone and that the telephone also rings at the Customer Terminal

Note: At this point, in each Terminal, the “Power” and “Active” LEDs in the Transmitter and Receiver modules and the “Active” LED in the Controller modules should be lit.

Also, the 8087 Line Interface module Channel A ‘M Wire’ LED at the Exchange Terminal and the 8088 Line Interface module Channel A ‘E Wire’ LED at the Customer Terminal will light in time to the ringing cadence.

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B “Troubleshooting Guide”.

When the telephone is answered at the Customer Terminal, confirm that:

- > audio traffic (speech, fax or modem data) is successfully reproduced at each end without noise, distortion etc
- > internally generated audio alarm tones are not present¹

Note: At this point, the Channel A ‘E Wire’ LED at the Exchange Terminal and the Channel A ‘M Wire’ LED at the Customer Terminal will light continuously.

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B “Troubleshooting Guide”.

Test call for Channel B

Repeat the process with the test telephone connected to the appropriate Channel B socket on the Exchange Terminal, dialling the number for the telephone connected to Channel B of the Customer terminal.

Note: References to Channel A ‘M’ and ‘E’ wire LEDs should be replaced with Channel B as necessary.

3.10.2 Test Call originating from the Customer Terminal

Connect a telephone to the appropriate Channel A socket on the Customer Terminal and lift it off-hook.

- > Confirm that dial tone can be heard in the telephone

Note: At this point, in each Terminal, the “Power” and “Active” LEDs in the Transmitter and Receiver modules and the “Active” LED in the Controller module should be lit.

¹ 3x alarms are generated, 1 beep = low power supply, 2 beeps = high VSWR, 3 beeps = low RSSI; refer to section 2.2.8 for further details.

In addition, the 8088 Line Interface module Channel A 'M Wire' LED at the Customer Terminal and the 8087 Line Interface module Channel A 'E Wire' LED at the Exchange Terminal will light continuously

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B "Troubleshooting Guide".

Dial the number for the test telephone connected to Channel A of the Exchange Terminal and confirm that:

- > Ringing can be heard in the telephone and that the test telephone also rings at the Exchange Terminal

Note: At this point, when dialling with a decadic (pulse) telephone, the Channel A 'M Wire' LED at the Customer Terminal and the Channel A 'E Wire' LED at the Exchange Terminal will light in time to the ringing cadence.

When the telephone is answered at the Exchange Terminal, confirm that:

- > audio traffic (speech, fax or modem data) is successfully reproduced at each end without noise, distortion etc
- > internally generated audio alarm tones are not present (see Section 3.10.1)

Note: At this point, the Channel A 'M Wire' LED at the Customer Terminal and the Channel A 'E Wire' LED at the Exchange Terminal will light continuously.

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B "Troubleshooting Guide".

Test call for Channel B

Once satisfied with the test call for Channel A, repeat the process with the telephone connected to the appropriate Channel B socket on the Customer Terminal, dialling the number for the telephone connected to Channel B of the Exchange terminal.

Note: References to Channel A 'M' and 'E' wire LEDs should be replaced with Channel B as necessary.

3.11 Brief Overview – Point to Point operation

When configured for Point to Point operation, the Hawk link will respond to the following initiating condition:

- > Grounding of the M Wire line at either Terminal

Upon receipt of this condition, the Controller module at the initiating terminal will become active, keying the Transmitter module and transmitting any traffic that is present on the Channel A or Channel B 4-Wire Tx line at the initiating Terminal.

The Receiver module at the corresponding Terminal activates upon detection of a valid RF signal and passes the received traffic out of the Channel A or Channel B 4-Wire Rx line.

Note: In Point to Point mode, the Link establishment time must be kept to a minimum, hence, the audio channel is opened once the RF link is first established. There is no "handshake" or Ident code recognition process between Terminals, unlike in Telephone mode.

Depending on the operating mode, the Transmitter module at the corresponding Terminal may automatically awaken to establish a Full-Duplex path, see below.

Basic or Trunking Point to Point operation

A Hawk Point to Point link has two possible modes of operation, Basic and Trunking.

- > **Basic mode** operates in a Half-Duplex manner with VF communication normally occurring in one direction only. Grounding of the M Wire at the initiating terminal allows data/traffic to be transmitted from that terminal and received at the corresponding terminal.
- > **Trunking mode** operates in a Full-Duplex manner with communication occurring in each direction simultaneously. Grounding of the M Wire at either terminal allows data/traffic to be transmitted and received at each terminal.

3.11.1 Test call for Basic Point to Point operation (Terminal 1 to Terminal 2)

Unlike Telephone operation, the test call process is identical between Terminals, the only difference is the direction that data/traffic is sent and received across the Link.

Using the 6-wire cable provided, ground the M Wire line in the appropriate Channel A socket of Terminal 1 and check that:

- > The Transmitter Module in Terminal 1 is activated
- > The Receiver Module in Terminal 2 is activated

Note: At this point, in Terminal 1, the “Power” and “Active” LEDs in the Transmitter Module, the “Active” LED in the Controller module and the Line Interface module Channel A ‘M Wire’ LED should be lit.

In Terminal 2, the “Power” and “Active” LEDs in the Receiver Module, the “Active” LED in the Controller module and the Line Interface module Channel A ‘E Wire’ LED should be lit.

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B “Troubleshooting Guide”.

Apply 4-Wire Tx data to Terminal 1 via the 6-wire cable and ensure that:

- > Data/traffic is successfully reproduced without errors, noise, distortion etc via the 6-wire cable, connected to the appropriate Channel A socket of Terminal 2.
- > internally-generated audio alarm tones are not present (see Section 3.10.1)

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B “Troubleshooting Guide”.

Test call for Channel B

Once satisfied with the test call for Channel A, repeat the process with the 6-wire cables connected to the appropriate Channel B socket on Terminal 1 and Terminal 2 as required.

Note: References to Channel A ‘M’ and ‘E’ wire LEDs should be replaced with Channel B as necessary.

3.11.2 Test call for Basic Point to Point operation (Terminal 2 to Terminal 1)

Repeat the process described in Section 3.11.1, replacing Terminal 1 and Terminal 2 references as necessary, to ensure that data/traffic can be transmitted from Terminal 2 and received at Terminal 1.

Test call for Channel B

Once satisfied with the test call for Channel A, repeat the process with the 6-wire cables connected to the appropriate Channel B socket on Terminal 1 and Terminal 2 as required.

Note: References to Channel A 'M' and 'E' wire LEDs should be replaced with Channel B as necessary.

3.11.3 Test call for Trunking Point to Point operation

As previously mentioned, when configured for Trunking Point to Point mode, a Full Duplex path is set up upon grounding of the M Wire line in either Terminal.

Test call for Channel A

Using the 6-wire cable provided, ground the M Wire line in the appropriate Channel A socket of Terminal 1 and check that:

- > The Transmitter and Receiver Modules in Terminal 1 are activated
- > The Transmitter and Receiver Modules in Terminal 2 are activated

Note: At this point, in each Terminal, the "Power" and "Active" LEDs in the Transmitter Module, the "Active" LED in the Controller module and the Line Interface module Channel A 'E Wire' and 'M Wire' LEDs should be lit.

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B "Troubleshooting Guide".

Apply 4-Wire Tx data to Terminal 1 via the 6-wire cable and ensure that:

- > Data/traffic is successfully reproduced without errors, noise, distortion etc via the 6-wire cable, connected to the appropriate Channel A socket of Terminal 2.
- > internally-generated audio alarm tones are not present (see Section 3.10.1)

Apply 4-Wire Tx data to Terminal 2 via the 6-wire cable and ensure that:

- > Data/traffic is successfully reproduced without errors, noise, distortion etc via the 6-wire cable, connected to the appropriate Channel A socket of Terminal 1.
- > internally-generated audio alarm tones are not present (see Section 3.10.1)

If this is not the case, or if the Link shuts down unexpectedly, refer to Appendix B "Troubleshooting Guide".

Test call for Channel B

Once satisfied with the test call for Channel A, repeat the process with the 6-wire cables connected to the appropriate Channel B socket on Terminal 1 and Terminal 2 as required.

Note: References to Channel A 'M' and 'E' wire LEDs should be replaced with Channel B as necessary.

3.12 Recording Common Meter Readings

After the test call procedure is performed at each Terminal, it is useful to record some of the most common meter readings. This will enable you to monitor the link's performance in the future. It is also a valuable aid in any future fault finding.

The common meter readings that can be monitored during a "test link" (i.e. selecting "F0" as above) are shown below, described either as LCD # or PC Title, depending on the monitoring method used.

Note: When a test link is set up, it is possible to monitor the meter readings for both the 'Local' and 'Remote' Terminal from a single Terminal, without having to travel to the second site.

LCD #	PC Title	Description	Recorded Reading
0	L.RSSI	Local Received Signal Strength Indication	
1	R.RSSI	Remote RSSI.	
2	L.VSWR	Local VSWR.	
3	R.VSWR	Remote VSWR.	
4	L.TxPw	Local transmitter power.	
5	R.TxPw	Remote transmitter power.	

Table 3.6: Common Meter Readings

An example of a common meter reading on the LCD is shown in Figure 3.15

Note: The Laptop PC will show the information in a different way, e.g. L.RSSI: 68%)

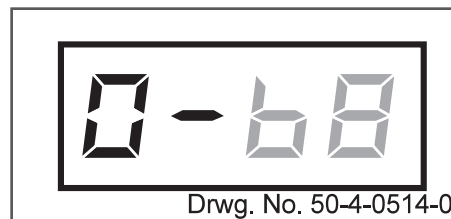


Figure 3.15: Meter reading on the LCD

3.12.1 Procedure using the 8080 Controller module front panel buttons and LCD

Note: The following instructions assume that the Hawk terminal wall mount cover has already been removed and that all necessary cables are connected at each Terminal location.

Step	Action
1	Press the top button on the module if the LCD is blank. This activates the terminal. Continue to press the top button until the LCD displays "F0.—" (Force a Link – establishes a Link without requiring correct Ident Code).
2	Press the bottom button. The Terminal will power up and the "—" on the LCD display will change to show the other terminal's ident code. This completes the set-up of a Test Link.
3	Step back through the display by holding the top button down and then pressing the bottom button until "0-XX" is displayed where XX is the value to be recorded in position '0' in Table 3.6 as necessary.
4	Press the top button to scroll through the other common meter readings, recording the displayed values against positions '1' to '5' in Table 3.6
5	Step back through the display by holding the top button down and then pressing the bottom once until it shows "F2". Press the bottom button to turn off the test link.
6	Step back through the menu until it shows "OFF" and press the bottom button to turn off the local controller.

3.12.2 Procedure using a Laptop PC connected to socket SK106

It is possible to perform this procedure via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) to access information via the RS232 socket on the front panel of the 8080 Controller Module.

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.8 for pin-out details.

Step	Action
1	Press any key on the PC if the screen is blank. This activates the terminal. Follow the instructions that are displayed to access the software menu (<u>default</u> is to press the 'A' key three times)
2	Press "N" on the keypad until the screen displays "Force a Link" (This establishes a Link without requiring the correct Ident Code).
3	Press "Enter". The Terminal will power up and the display will change to show the other terminal's ident code. Press any key to continue. This completes the set-up of a Test Link.
4	Press "P" until "R.TxPw:XX%" is displayed where XX is the value to be recorded in position '5' in Table 3.6. Press 'P' to scroll through the other common meter readings, recording the displayed values against positions '4' to '0' in Table 3.6 as necessary
5	Scroll through the display by pressing "P" until it shows "Cleardown Link". Press "Enter" to turn off the test link.
6	Press "Q" to display "Go to sleep" and press "Enter" to turn off the local controller.

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4

System Set-up and Alignment

4.1 General

System set-up and alignment takes place in both the Hawk's software and hardware. The adjustments covered in this section are:

- > Telephone link configuration,
- > Point-to-point link configuration,
- > Terminal RF output power,
- > Terminal send and receive line levels,
- > 2-wire Adaptive Hybrid Balance adjustment
- > Terminal transmit and receive frequencies,
- > Addition of a new power supply,
- > Adapting the link for payphone operation.

4.2 Link Configuration Options

The dual channel Hawk terminal provides two individual line connections with each channel operating independently of the other.

4.2.1 Selectable Links

The desired configuration for each channel is set via DIP switches on the Type 8087 or Type 8088 Line Interface module PCB as shown in Figures 4.4 and 4.5 and Tables 4.1a-e and 4.2a-f.

4.2.2 Ident Code

The terminal Ident Code must be correctly set to match the desired configuration for each channel.

Note: If each channel is set for Telephone operation, the Ident Code setting covers both channels with a single number. If either channel is set for Point to Point operation, it is necessary to set the correct Ident Code for each channel.

The terminal Ident Code is software selectable within the Type 8080 Controller module (the code for each channel is set within this module).

Refer to Section 2.9 for further details concerning Ident Code selection.

4.3 Telephone Operation

Telephone operation requires an Exchange configuration (with either a 2-wire or a 4-wire plus E and M wire line connection) at the Exchange terminal and a Subscriber configuration (with a 2-wire line connection) at the Customer terminal.

- > The Ident Code can be set for any number between 0-9 and must be identical in each terminal for correct operation.

Refer to Section 2.9 for further details concerning Ident Code selection.

4.4 Point to Point Operation

Point to Point operation requires a 4-wire plus E and M wire line connection at each terminal.

- > The Type 8087 Exchange Line Interface module can provide the 4-wire plus E and M wire line connection for both channel A and channel B.
- > The Type 8088 Subscriber Line Interface module can provide the 4-wire plus E and M wire line connection on channel A ONLY (see also Section 4.5 below).

For this reason, if Point to Point operation is required on BOTH channels, each terminal **must** contain the Type 8087 Exchange Line Interface module.

- > The Ident Code **must** be set for PP1 (Channel A) and PP2 (Channel B).

Refer to Section 2.9 for further details concerning Ident Code selection.

Basic or Trunking Point to Point operation

A Hawk Point to Point link has two possible modes of operation, Basic and Trunking.

- > **Basic mode** operates in a Half-Duplex manner with VF communication normally occurring in one direction only. Grounding of the M Wire at the initiating terminal allows data/traffic to be transmitted from that terminal and received at the corresponding terminal.
- > **Trunking mode** operates in a Full-Duplex manner with communication occurring in each direction simultaneously. Grounding of the M Wire at either terminal allows data/traffic to be transmitted and received at each terminal.

4.5 Mixed Telephone/Point to Point Configuration

A dual channel Hawk link can have one audio channel in Point to Point mode and the other in Telephone mode. This is known as Mixed Mode operation.

- > If Mixed Mode operation is required, one terminal must contain the Type 8087 Exchange Line Interface module and the other terminal **must** contain the Type 8088 Subscriber Line Interface module.



In this mode, Channel A must be configured for Point to Point operation and Channel B must be configured for Telephone operation.

Refer to Section 2.9 for further details concerning Ident Code selection.

4.6 Accessing the Controller and Line Interface Modules

Note: The following access instructions assume that the Hawk terminal has already been removed from its mounting.

Removal of the wall mount cover is necessary to allow access to the internal modules.

- 1 Lay the terminal on a flat surface, with the base plate uppermost.
- 2 Remove the two screws (complete with washers) at the sides of the terminal (see Figure 4.1) and store them in a safe place.
- 3 Turn the terminal over so that the cover is now uppermost and lift the cover off the terminal.

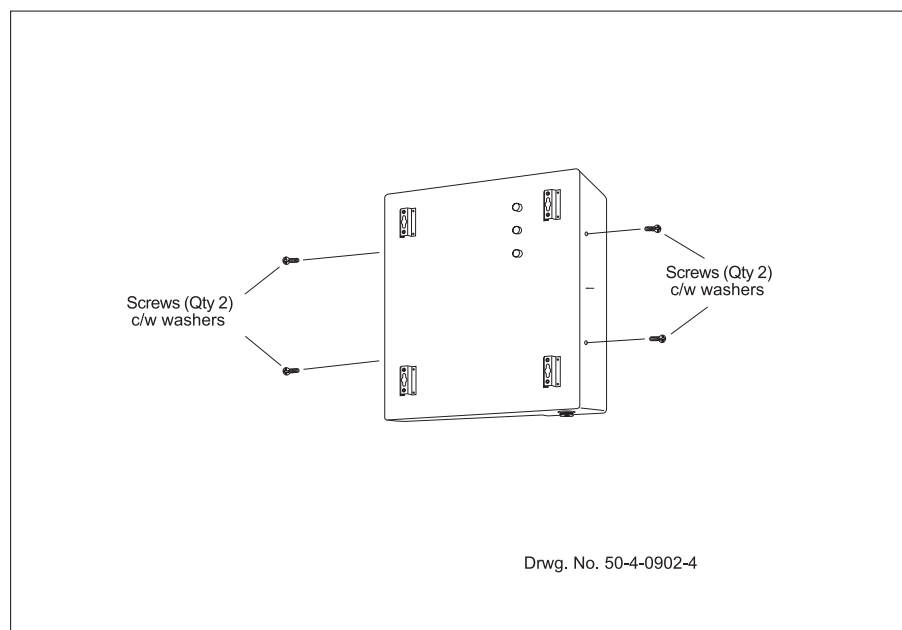


Figure 4.1: Wall Mount Cover Removal

4.6.1 Line Interface Module (Type 8087 Exchange and Type 8088 Subscriber)

As either Line Interface PCB is secured to the top of the Type 8080 Controller module, it can be accessed as soon as the wall mount cover is removed.

Section 4.7 and Tables 4.1a-e and 4.2a-f detail the various configuration options for the Type 8087 or 8088 Line Interface modules.

4.6.2 Type 8080 Controller Module

It is necessary to remove the Type 8080 Module from the chassis, to allow access to the module PCB.

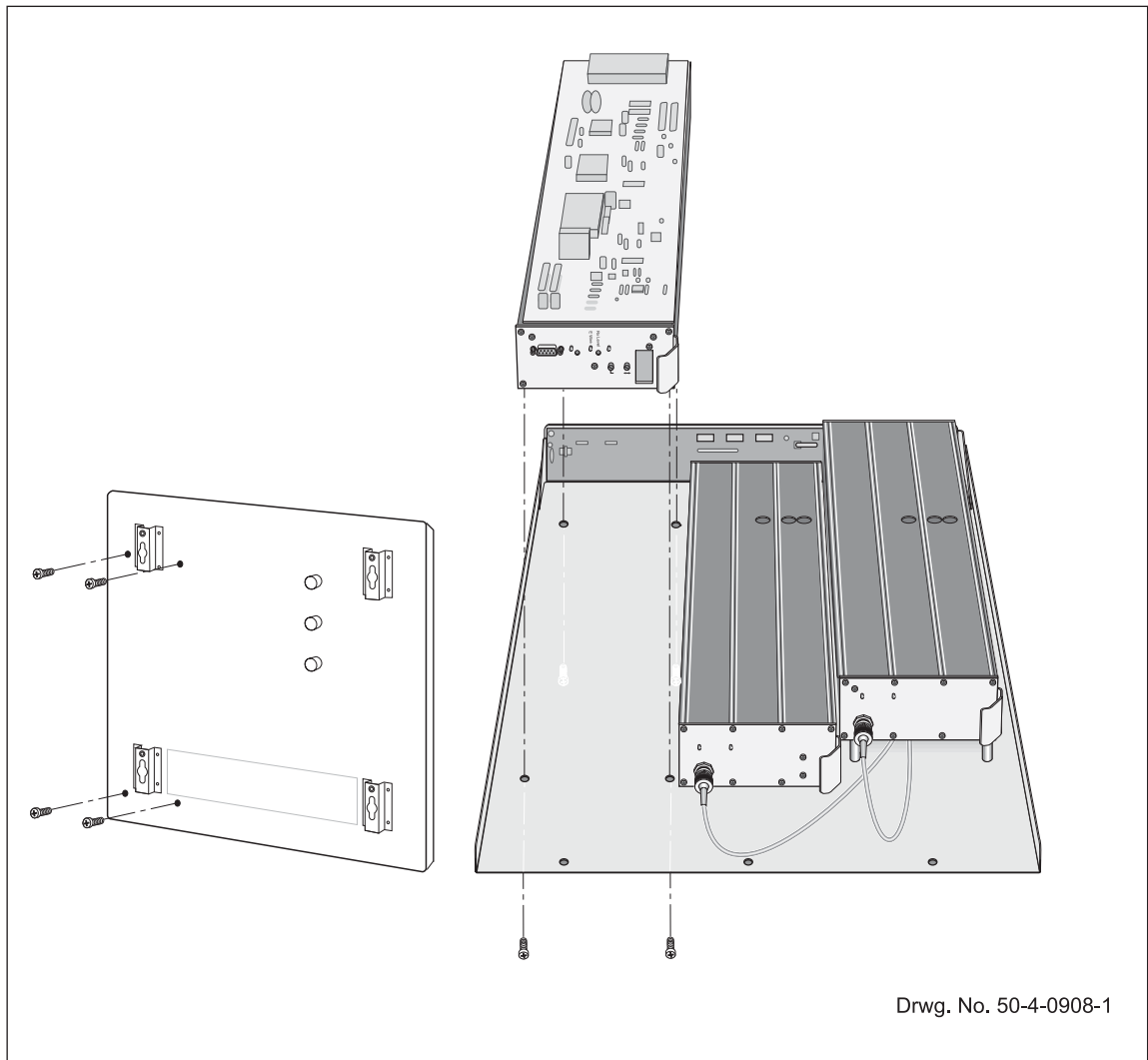


Figure 4.2: Removing Controller Module from the Wall Mount Terminal

Removal of Type 8080 Controller module

To remove the PCB from a Type 8080 Controller module, proceed as follows:

1. Identify and remove the four screws on the underside of the wall mount chassis that hold the controller module in position (see Figure 4.2 above) Save the screws for refitting.
2. To enable the controller module to be removed, it is necessary to remove the Line Interface PCB that is fitted to the top of the controller module. Carefully remove the locking pin from the Line Interface module connector (save for refitting) and then gently ease both modules forward until both connectors disengage.
3. On the controller module face plate, undo and save each of the four screws on the corners (see Figure 4.3)



The face plate screws have No.2 Japan Industry Standard (JIS) heads. Damage to screw heads may result if the incorrect screw tips are used. The closest alternative is a No.2 Phillips.

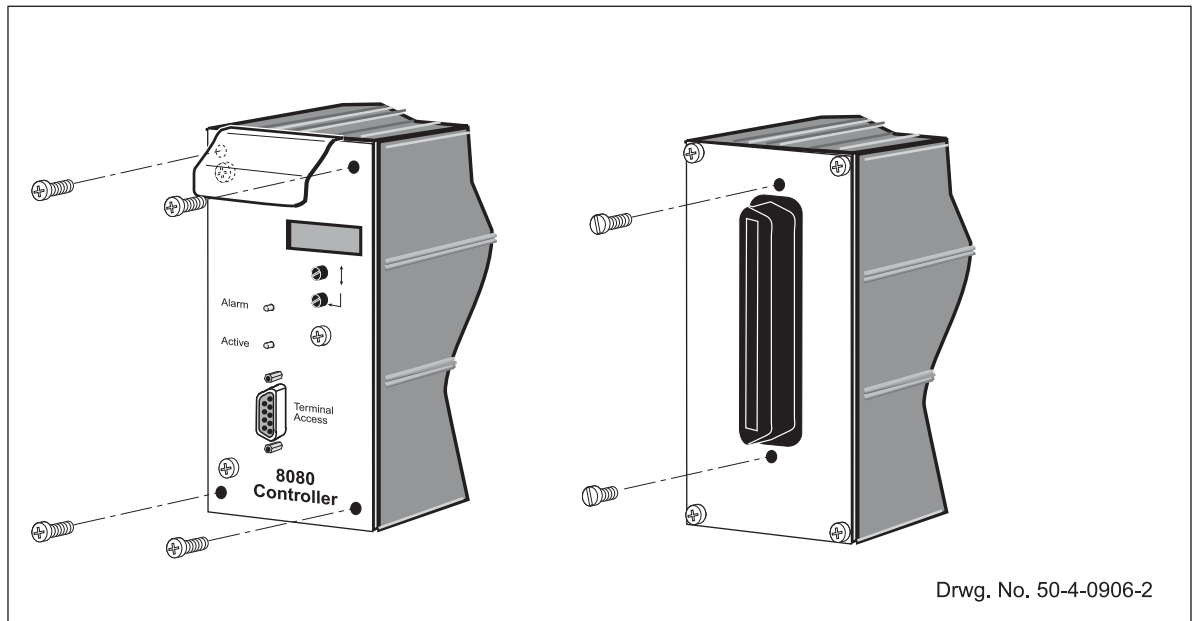


Figure 4.3: Module Face and Rear Plate Screws

4. In the controller module rear plate, undo and save the two screws that hold the connector (see Figure 4.3)
5. Gently extract the PCB from the module.

Re-insertion of Type 8080 Controller module

To insert a PCB into a Type 8080 Controller module:

1. Insert the PCB through the front of the module, taking care to line up the connector with the hole in the rear plate.
2. Insert a screw into each hole in the PCB connector and tighten (see Figure 4.3).
3. Insert and tighten a screw through each of the holes in the corners of the face plate (see Figure 4.3).
4. Align the module into position on the wall mount chassis. Take care that the holes in the module line up with the four holes in the chassis (see Figure 4.2) and that the PCB connector on the module fits snugly into the socket on the motherboard.

Ensure that the Line Interface PCB is fitted to the top of the Controller module and that its PCB connector fits snugly into its socket on the motherboard. Re-insert the locking pin on the Line Interface connector.

5. Using the four screws kept from the removal of the controller module; fit a screw through each of the holes in the chassis. Tighten the screws to secure the module.

4.7 Configuration of 8087 or 8088 Line Interface modules

As mentioned in Section 4.2, the desired configuration for each channel is set via various DIP switches on each Type 8087 (Exchange) or Type 8088 Line Interface module PCB.

Refer to Figures 4.4, 4.5 and Tables 4.1a-e and 4.2a-f for further details.

4.7.1 Type 8087 Exchange Line Interface module

As the Line Interface PCB is secured to the top of the Type 8080 Controller module, it can be accessed as soon as the wall mount cover is removed.

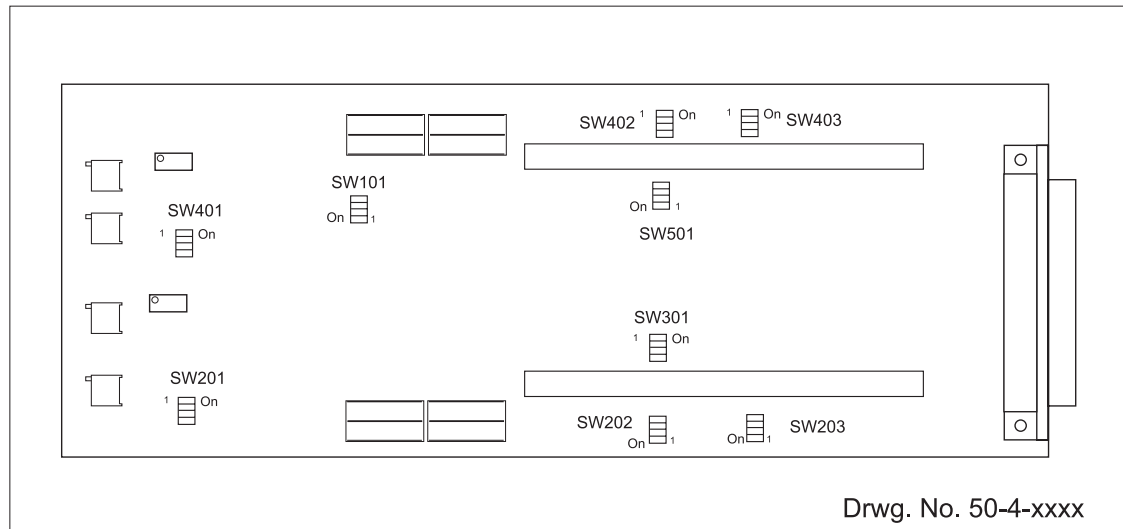


Figure 4.4: Type 8087 Exchange Line Interface DIP Switch Locations

4.7.3 Operating Configuration Table

Tables 4.1a to 4.1e below can be used to confirm the relevant linking on the Type 8087 Exchange Line Interface module prior to terminal installation.

DIP Switch SW101 Power Supply

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	12V supply to Vbat generator	Off	On
2	12V unswitched supply to +/-5V rail to COIC	On	Off ¹
3	Not Connected	Off	Off
4	4-wire 12V switched supply rail to COIC	Off	On

Table 4.1a: 8087 Power Supply

¹ Pin 2 must be ON if low voltage (+5V) M-wire is required

DIP Switches SW201 (Channel A) and SW401 (Channel B) Audio Mute

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	Mutes 2-wire audio	Off	On
2	Mutes 4-wire audio	On	Off
3	Not Connected	Off	Off
4	Not Connected	Off	Off

Table 4.1b: 8087 Audio Mute

DIP Switches SW202 (Channel A) and SW402 (Channel B) Wire Impedance

Pin	Description
1	TN12
2	600 Ω
3	900 Ω
4	Not Connected

Table 4.1c: 8087 2-Wire Impedance

DIP Switches SW203 (Channel A) and SW403 (Channel B) Balance Network

Setting (Note: Select one option only)	2-wire Balance Network
All = OFF	Matches impedance selected via SW202 and 402 above
All = ON	TN12 (regardless of impedance selected via SW202 and 402above)

Table 4.1d: 8087 2-wire Balance Network

DIP Switches SW301 (Channel A) and SW501 (Channel B)

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	Low (+5V) M-wire	-	*
2	Negative M wire (Type I) ¹	-	*
3	Positive M wire (Type V) ²	-	*
4	Link to prevent E-wire looping the 2-wire port on the COIC.	On	Off

(*) Only one M Wire mode may be selected at one time therefore only pins 1,2 or 3 should be on i.e. not more than one should be on at the same time.

(-) Not applicable to this mode of operation.

Table 4.1e: 8087 M Wire

¹ Negative M-wire (Type I) requires Vbat (-48VDC) to be applied to the M-wire lead.

² Positive M-wire (Type V) requires GND to be applied to the M-wire lead.

4.7.4 Type 8088 Subscriber Line Interface module

As the Line Interface PCB is secured to the top of the Type 8080 Controller module, it can be accessed as soon as the wall mount cover is removed

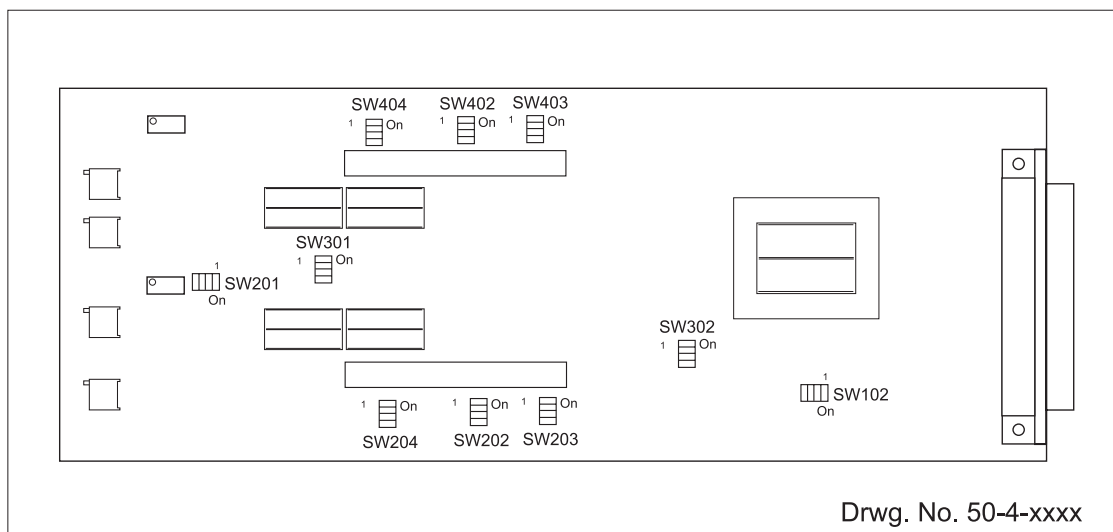


Figure 4.5: Type 8088 Subscriber Line Interface DIP Switch Locations

Operating Configuration Table

Tables 4.2a to 4.2f below can be used to confirm the relevant linking on the Type 8088 Subscriber Line Interface module prior to terminal installation.

DIP Switch SW102 Ring Frequency

Pin	Description	18Hz	25Hz
1	Not Connected	Off	Off
2	Not Connected	Off	Off
3	Not Connected	Off	Off
4	Ringing Frequency	Off	On

Table 4.2a: 8088 Ring Frequency

DIP Switch SW201 Audio Mute (Channel A)

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	Mutes 4-wire audio	On	Off
2	Mutes 2-wire audio	Off	On
3	Not Connected	Off	Off
4	Not Connected	Off	Off

Table 4.2b: 8088 Audio Mute

DIP Switches SW202 and SW203 (Channel A), SW402 and SW403 (Channel B)
2-wire Impedance

Description	SW202 SW402	SW203 SW403
TN6 ¹	All On	All Off
TN12 ¹	All Off	All On

Table 4.2c: 8088 2-wire Impedance

DIP Switches SW204 (Channel A) and SW404 (Channel B)

Line Current	Pin 1	Pin 2	Pin 3	Pin 4
20 mA	Off	On	Off	Off
24 mA	Off	Off	Off	Off
45 mA	On	Off	Off	Off

Table 4.2d: 8088 Line Current

DIP Switch SW301 Power Supply (Channel A)

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	4-wire 12V switched supply	Off	On
2	Not Connected	Off	Off
3	Not Connected	Off	Off
4	Not Connected	Off	Off

Table 4.2e: 8088 Power Supply

DIP Switches SW302 (Channel A)

Pin	Description	2-wire operation	4-wire + E & M wire operation
1	Low (+5V) M-wire	-	*
2	Negative M wire (Type I) ¹	-	*
3	Positive M wire (Type V) ²	-	*
4	Not Connected	On	Off

(*) Only one M Wire mode may be selected at one time therefore only pins 1,2 or 3 should be on i.e. not more than one should be on at the same time.

(-) Not applicable to this mode of operation.

Table 4.2f: 8088 M-wire

¹ Select only one impedance setting at a time e.g. if TN6 is required then SW202 and 402 should all be ON and SW203 and SW403 should all be OFF

¹ Negative M-wire (Type I) requires Vbat (-48VDC) to be applied to the M-wire lead

² Positive M-wire (Type V) requires GND to be applied to the M-wire lead.

4.8 Terminal RF Output Power Adjustment

4.8.1 General

The RF output power is adjusted using a multi-turn potentiometer in the transmitter module. Rotating the potentiometer in a clockwise direction increases the power and rotating in an anti-clockwise direction decreases the power. The potentiometer is adjusted through a hole on the right hand side of the module shroud (see Figure 4.6).

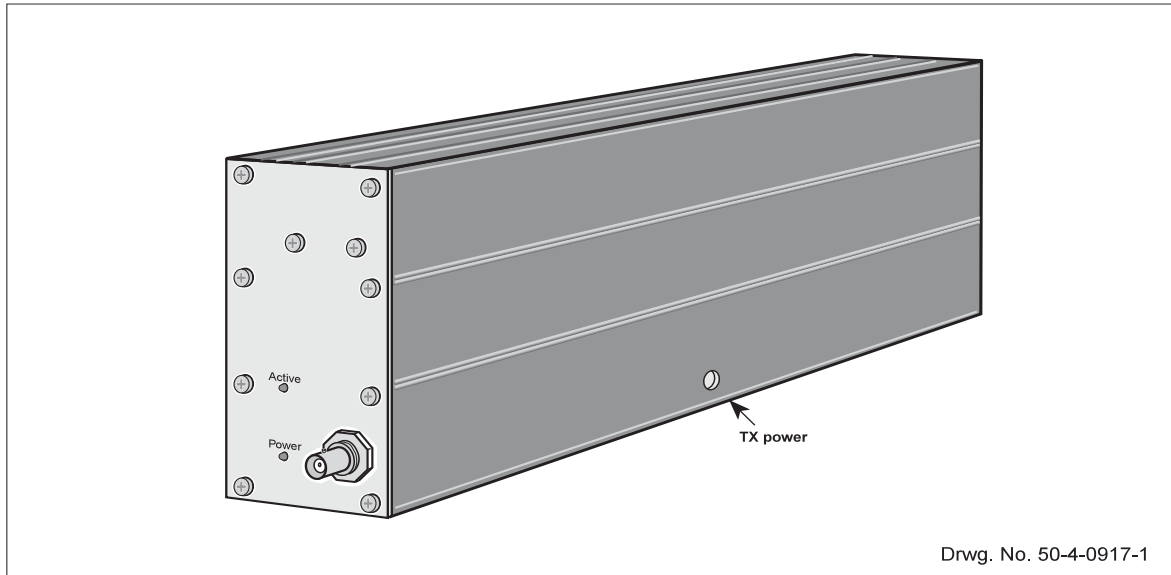


Figure 4.6: Transmitter Module Power Adjustment

To adjust the RF output power of a wall mount terminal, proceed as follows:

1. Transmitter output power can be adjusted without removing the cover. Leave all cabling connected and remove the terminal from its mounting.
2. Activate the terminal.
3. Identify the hole on the underside of the terminal through which the potentiometer can be adjusted,
4. Using a suitable screwdriver, adjust the potentiometer as required. Check the transmitter output power using an in-line RF Wattmeter in the antenna feeder.
5. Refer to Section 4.8.2 and check the RSSI at the remote terminal.
6. Refer to Section 4.8.3 and recalibrate the transmitter,
7. After re-calibrating the transmitter, replace the terminal on the wall. Ensure that all cables are connected and secure.
8. Perform a final check on the terminal to ensure correct operation.

4.8.2 Checking the Remote Terminal RSSI

The RSSI at the remote terminal can be checked using the buttons and the LCD on the front of the controller module, or using a Laptop PC.

If using a Laptop PC ensure that the port connected to the Hawk2 is configured as shown in the table below.

Description	Configuration
Bits Per Second	1200
Data Bits	7
Parity	Even
Stop Bits	1
Flow Control	None

Procedure using the 8080 Controller module front panel buttons and LCD

Note: The following instructions assume that the Hawk Terminal has already been removed from its mounting to allow the wall mount cover to be removed as detailed in Section 4.6.

Step	Action
1	Press the top button on the module if the LCD is blank. This activates the terminal. Continue to press the top button until the LCD displays "F0.—" (Force a Link – establishes a Link without requiring correct Ident Code).
2	Press the bottom button. The Terminal will power up and the "—" on the LCD display will change to show the other terminal's ident code. This completes the set-up of a Test Link.
3	Press the top button on the module until the LCD displays "1—" followed by two digits indicating the RSSI at the remote terminal. This value should be 50 or greater for adequate link performance.
4	Press the top button until the LCD displays "F2" (cleardown link). Press the bottom button to close the Test Link.
5	Press the top button until the LCD displays "OFF". Press the bottom button to shut down the Terminal.

Procedure using a Laptop PC or Video Display Terminal

It is possible to check the remote terminal RSSI via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) or an ASCII Video Display Terminal (VDT) to access information via RJ45 socket SK106.

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.10 or Appendix D for pin-out details

Step	Action
1	Press any key on the PC if the screen is blank. This activates the terminal. Follow the instructions that are displayed to access the software menu (<u>default</u> is to press the 'A' key three times).
2	Press "N" on the keypad until the screen displays "Force a Link" (This establishes a Link without requiring the correct Ident Code).
3	Press "Enter". The Terminal will power up and the display will change to show the other terminal's ident code. Press any key to continue. This completes the set-up of a Test Link.
4	Press "N" on the keypad until the screen displays "R.RSSI". Press "Enter" and a percentage figure will be shown, indicating the RSSI at the remote terminal. This value should be 50% or greater for adequate link performance.
5	Scroll through the display by pressing "P" until it shows "Cleardown Link". Press "Enter" to turn off the test link.
6	Press "Q" to display "Go to sleep" and press "Enter". The terminal is now turned off.

4.8.3 Calibrating the Transmitter Forward Power Meter

The transmitter forward power meter reading shows 99% for full power. If you have to adjust the transmitter for a different power output or install a new transmitter, the meter reading will no longer be correct. You must then re-calibrate the meter reading against the actual power output.

Procedure using the 8080 Controller module front panel buttons and LCD

Step	Action
1	Scroll through the menu using the top button until you see "F8".
2	Press and release the bottom button and the display will flash.
3	Press and hold the bottom button until the display stops flashing (approximately five seconds).
4	The transmitter meter reading is now calibrated to display 99% at the current power output

Note: If you do not hold the bottom button down until the display stops flashing, the meter will not be calibrated.

Procedure using a Laptop PC or Video Display Terminal

Step	Action
1	Press any key on the PC if the screen is blank. This activates the terminal. Follow the instructions that are displayed to access the software menu (<u>default</u> is to press the 'A' key three times).
2	Press "N" on the keypad until the screen displays "Tx meter Cal".
2	Press "Enter". The display changes to "Y to confirm".
3	Press "Y" and the meter is calibrated.
4	Press "Q" to display "Go to sleep" and press "Enter" to turn off the local controller.

4.9 Terminal Send and Receive Line Levels**4.9.1 General**

The send and receive line levels of a terminal should have been set during manufacture, but adjustment may be necessary to compensate for line loss at either terminal.



Do not attempt to alter line levels to compensate for a single piece of equipment because if any other equipment is connected to the line they will be operating at the wrong level.



Do not ground the M-wire on the exchange terminal for longer than 20 seconds as more than 20 seconds of continuous ringing will damage the components in the subscriber terminal.

The default factory line levels of a Hawk system when shipped (except where specified by customer order) are as follows:

Send Level		Receive Level
Subs 0dBm	to	Exch -3dBm
Exch -6dBm	to	Subs -9dBm

It is normal to have a 3dB loss in both directions to prevent hybrid feedback (singing). An example of compensating for line loss is when there was a 6dB line loss between the exchange and exchange terminal. The exchange transmit level would be adjusted to -12dBm and the subs receive level would be adjusted to -15dBm.

Note: It is uncommon to have a send level lower than -16dBm, and not possible for the system to accept a send level greater than +4dBm.

4.9.2 Line Level Adjustment Procedure

Two methods of setting up line levels are available. They are the simplified method, where the system is installed in the field and only one terminal is available for adjustment at any one time, and the complete method, where the link is set up on a test bench so that the technician has access to both terminals simultaneously.

Note: The complete method should be used in preference to the simplified method whenever possible.

SIMPLIFIED METHOD

The procedure below is for one terminal (exchange or customer). For the other terminal, use the same procedure. Refer to Figures 4.7 and 4.8 for the location of adjustment points.

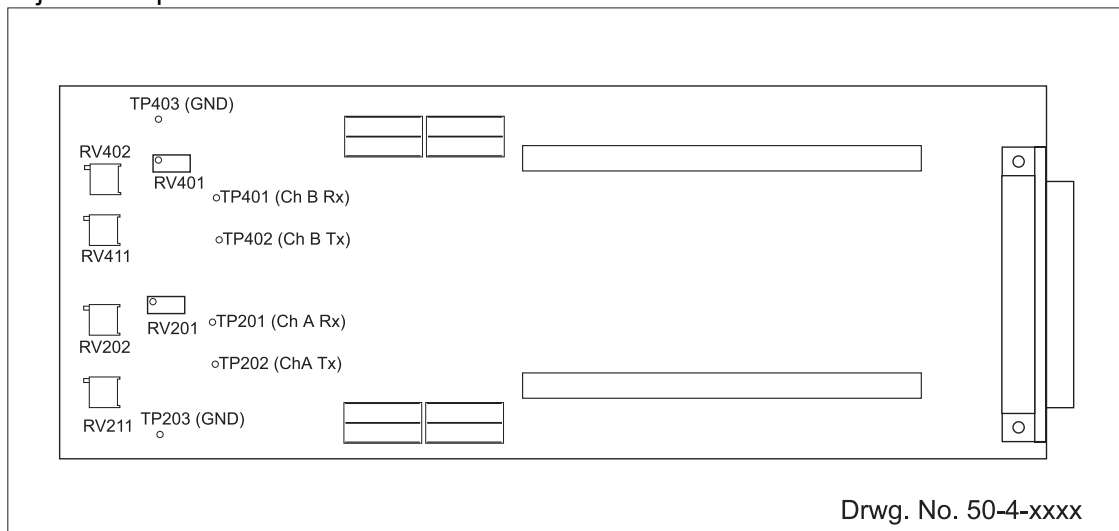


Figure 4.7: Type 8087 Exchange Module Line Level Measurement and Adjustment Locations

- Key**
- RV201 = Channel A Rx Compander gain adjustment
 - RV202 = Channel A Rx level adjustment
 - RV211 = Channel A Tx level adjustment
 - RV401 = Channel B Rx Compander gain adjustment
 - RV402 = Channel B Rx level adjustment
 - RV411 = Channel B Tx level adjustment

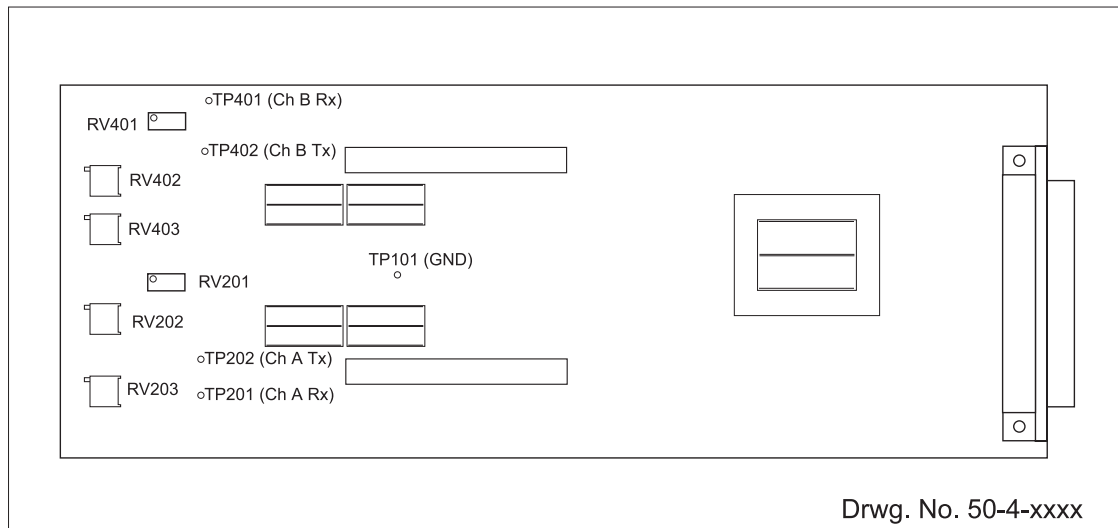


Figure 4.8: Type 8088 Subscriber Module Line Level Measurement and Adjustment Locations

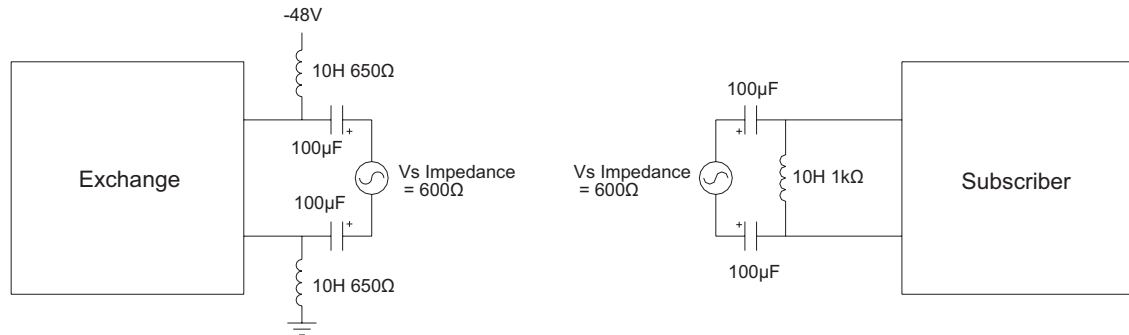
- Key**
- RV201 = Channel A Rx Compander gain adjustment
 - RV202 = Channel A Rx level adjustment
 - RV203 = Channel A Tx level adjustment
 - RV401 = Channel B Rx Compander gain adjustment
 - RV402 = Channel B Rx level adjustment
 - RV403 = Channel B Tx level adjustment

Tools Required

- > Audio Oscillator,
- > Audio Level Meter,
- > 2 x 10H, 650Ω inductors,
- > 1 x 10H, 1k Ω inductor,
- > 4 x 100 μF electrolytic capacitors

Recommended Connection Method of Measurement Instruments

In order to protect the instruments from potential damage or cause inaccurate adjustment of the Hawk2 the equipment should be connected as shown below. The connected equipment should have 600Ω termination impedances. These circuits are derived from information provided by the component manufacturer. Note that the –48VDC power source shown on the exchange adjustment circuit needs to be capable of supplying up to 100mA.



Drwg. No. 50-4-0944

Figure 4.9 Recommended Connection Method for Adjustment Tools

Send Line Level Setting

To adjust the Send Line Level for Channel A of a dual channel system, proceed as follows:

1. Press the top button on the controller module if the LCD is blank. This activates the terminal.
2. Continue to press the top button until the LCD shows “8-” followed by two digits.
3. Connect the audio oscillator to the relevant Channel A socket (2-wire or 4-wire + E and M),
4. Use the audio oscillator to apply a 1 kHz tone at the desired transmit line level,
5. Adjust the Tx Level potentiometer (RV211 Exch, RV203 Subs) on the Interface module until the LCD reads “8-50”. This completes the adjustment.

To adjust the Send Line Level for Channel B of a dual channel system, proceed as follows:

1. Press the top button on the controller module if the LCD is blank. This activates the terminal.
2. Continue to press the top button until the LCD shows “9-” followed by two digits.
3. Connect the audio oscillator to the relevant Channel B socket (2-wire or 4-wire + E and M),
4. Use the audio oscillator to apply a 1 kHz tone at the desired transmit line level,
5. Adjust the Tx Level potentiometer (RV411 Exch, RV403 Subs) on the interface module until the LCD reads “9-50”. This completes the adjustment.

Receive Line Level Setting

To adjust the Receive Line Level for Channel A of a dual channel system, proceed as follows:

1. Press the top button on the controller module if the LCD is blank. This activates the terminal.
2. Continue to press the top button until the LCD shows "8-" followed by two digits.
3. Connect the level meter to the relevant Channel A socket (2-wire or 4-wire + E and M),
4. Press the bottom button on the controller to send a calibrated 1 kHz tone to the Channel A socket,
5. Adjust the Rx Level potentiometer (RV202 Exch and Subs) on the Interface module until the desired line level reading is shown on the meter. This completes the adjustment.

To adjust the Receive Line Level for Channel B of a dual channel system, proceed as follows:

1. Press the top button on the controller module if the LCD is blank. This activates the terminal.
2. Continue to press the top button until the LCD shows "9-" followed by two digits.
3. Connect the level meter to the relevant Channel B socket (2-wire or 4-wire + E and M),
4. Press the bottom button on the controller to send a calibrated 1 kHz tone to the Channel B socket,
5. Adjust the Rx Level potentiometer (RV402 Exch and Subs) on the line interface module PCB until the desired line level reading is shown on the meter. This completes the adjustment.

COMPLETE METHOD (recommended wherever possible)

The complete line level alignment procedure described here is appropriate for use when it is possible to access both terminals simultaneously i.e. when they can be set up on a test bench.

Refer to Figures 4.7 and 4.8 for the location of adjustment points.

Tools Required

- > Audio Oscillator,
- > Audio Level Meter,
- > AC Voltmeter (e.g. FLUKE 70 series),
- > 2 x 10H, 650Ω inductors,
- > 1 x 10H, 1k Ω inductor,
- > 4 x 100 μF electrolytic capacitors

Recommended Connection Method of Measurement Instruments

In order to protect the instruments from potential damage or cause inaccurate adjustment of the Hawk2 the equipment should be connected as shown in figure 4.9. The connected equipment should have 600Ω termination impedances. These circuits are derived from information provided by the component manufacturer. Note that the – 48VDC power source shown on the exchange adjustment circuit needs to be capable of supplying up to 100mA.

Procedure for Exchange to Customer direction

The procedure below is described for Channel A or Channel B for the Exchange to Customer direction (i.e sending a signal from the Exchange Terminal to the Customer Terminal). The steps below must be followed in strict order or line level settings will be incorrect.

Note: Note that Channel B component references are shown in [] brackets. Other references are for Channel A

1. Connect the audio oscillator to the relevant socket (2-wire or 4-wire + E and M) of the Exchange Terminal. Set to the desired send level at 1kHz.
2. Connect the external level meter to the relevant socket (2-wire or 4-wire + E and M) of the Customer Terminal. This should cause the link to set-up, as the level meter loops the line with 600 Ohms.
3. Connect the AC Voltmeter between TP202 and TP203 [TP402 and TP403] on the 8087 Exchange Module and adjust the Tx Level potentiometer RV211 [RV411] on the 8087 module until the AC voltage measures 500mV RMS.
4. Connect the AC Voltmeter between TP201 [TP401] and TP101 on the 8088 Subscriber Module and adjust the compander gain potentiometer RV201 [RV401] on the 8088 Module until the AC voltage measures 500mV RMS. This must be done after the exchange module RV211 [RV411] has been set as per step 3 above or levels will be incorrect.
5. Adjust the Rx level potentiometer RV202 [RV402] on the 8088 Subscriber Module, to give the desired receive level on the external level meter.

Procedure for Customer to Exchange direction

The procedure below is described for Channel A or Channel B for the Customer to Exchange direction (i.e sending a signal from the Customer Terminal to the Exchange Terminal). The steps below must be followed in strict order or line level settings will be incorrect.

Note: Note that Channel B component references are shown in [] brackets. Other references are for Channel A

1. Connect the audio oscillator to the relevant socket (2-wire or 4-wire + E and M) of the Customer Terminal. Set to the desired send level at 1kHz.
2. Connect the external level meter to the relevant socket (2-wire or 4-wire + E and M) of the Exchange Terminal. This should cause the link to set-up, as the level meter loops the line with 600 Ohms.
3. Connect the AC Voltmeter between TP202 [TP402] and TP101 on the 8088 Subscriber Module and adjust the Tx Level potentiometer RV203 [RV403] on the 8088 module until the AC voltage measures 500mV RMS.
4. Connect the AC Voltmeter between TP201 [TP401] and TP203 [TP403] on the 8087 Exchange Module and adjust the compander gain potentiometer RV201 [RV401] on the 8087 Module until the AC voltage measures 500mV RMS. This must be done after the subscriber module RV203 [RV403] has been set as per step 3 above or levels will be incorrect.
5. Adjust the Rx level potentiometer RV202 [RV402] on the 8087 Exchange Module, to give the desired receive level on the external level meter.

The tables below summarise the sequence of adjustments as described above.

Summary

Exchange to Customer Direction

	Exchange Module	Subscriber Module
Channel A	RV211	RV201, RV202
Channel B	RV411	RV401, RV402

Customer to Exchange Direction

	Subscriber Module	Exchange Module
Channel A	RV203	RV201, RV202
Channel B	RV403	RV401, RV402

4.10 2-Wire Adaptive Hybrid Balance Function¹

A software feature in the 8080 Controller module will allow the user to perform 2-Wire adaptive hybrid balancing once each Terminal has been successfully configured and installed. This feature is designed to improve performance of the Hawk Link when used with cable lengths of 1 km or more.

Note: Performing the adaptive balance procedure is not recommended for cable lengths of less than 1 km as this could degrade performance.

The Hybrid Balance menu performs two functions that should be performed in the following order:

- > Channel A and B Null. Any existing (stored) coefficients in either Terminal can be nulled to remove them.
- > Channel A and B Training. This will initiate the sequence of actions for 'training' the Adaptive Balance filter coefficients. They are then stored into non-volatile memory addresses and are used to compensate for trans-hybrid error.

If the cable or Exchange equipment is then subsequently changed, the Training process should be performed again.

Note: The Training procedure should only be performed on the Exchange Terminal as the Exchange equipment will generally remain constant (equipment connected to the Customer Terminal may change at any time, depending on the type of telephone or modem used, therefore making any stored coefficients redundant)

4.10.1 Procedure using the 8080 Controller module front panel buttons and LCD

Note: The following instructions assume that the Hawk terminal has already been removed from its mounting to allow the wall mount cover to be removed as detailed in Section 4.6 .

It is first necessary to Null any existing coefficients in the applicable Channel(s) and then to 'train' the applicable Channel(s) in the Exchange Terminal only.

¹ It is NOT necessary to perform the Adaptive Balance process on any Terminal that is configured for 4-Wire plus E and M Wire operation (for either Telephone or Point to Point operation)

Channel A and/or Channel B Null

Step	Action
1	Press the top button on the module if the LCD is blank. This activates the terminal. Continue to press the top button until the LCD displays "F4-0"
2	Press the bottom button and the LCD will flash. Press the top button until the LCD displays "F4-2" (Ch A Null)
3	Press the bottom button and the LCD will stop flashing, indicating that the Channel A coefficients have been nulled.
4	Press the bottom button and the LCD will flash. Press the top button until the LCD displays "F4-3" and repeat step 3 above to null the coefficients in Channel B.
5	If the null procedure is being performed on the <u>Exchange</u> Terminal, refer to the 'Training' procedure below. If performed on the <u>Customer</u> Terminal, press the top button until the LCD displays "OFF". Press the bottom button until the LCD goes blank.

Channel A and/or Channel B Training (in Exchange Terminal only)

Step	Action
1	From Step 4 (Null) above. Press the bottom button and the LCD will flash. Press the top button until the LCD displays "F4-0" (Ch A Training). Press the bottom button and the LCD will stop flashing, indicating that Channel A has been successfully trained.
2	Press the bottom button and the LCD will flash. Press the top button until the LCD displays "F4-1" (Ch B Training) and repeat step 1 above to 'train' Channel B as necessary
3	Press the top button until the LCD displays "OFF". Press the bottom button until the LCD goes blank.

4.10.2 Procedure using a Laptop PC or Video Display Terminal

It is possible to perform the 'Null' and 'Training' procedure via a Laptop PC (running Windows HyperTerminal or a similar Terminal emulation program) or an ASCII Video Display Terminal (VDT) via RJ45 socket SK106.

If using a Laptop PC ensure that the port connected to the Hawk2 is configured as shown in section 4.8.2

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.10 or Appendix D for pin-out details

Channel A and/or Channel B Null

Step	Action
1	Press any key on the PC if the screen is blank. This activates the terminal. Follow the instructions that are displayed to access the software menu (<u>default</u> is to press the 'A' key three times).
2	Press "N" on the keypad until the screen displays "Hybrid Balance". Press "Enter" and the prompt "Train Channel A" is displayed.
3	Press "N" until the prompt "Null Channel A" is displayed. Press "Enter" and the display will read "Please Wait" and will then return after a few seconds to the previous prompt, indicating that the Channel A coefficients have been nulled.
4	Press "N" until the prompt "Null Channel B" is displayed. Repeat step 3 above to null the coefficients in Channel B.
5	If the null procedure is being performed on the <u>Exchange</u> Terminal, refer to the 'Training' procedure below. If performed on the <u>Customer</u> Terminal, press "Q" to display "Go to sleep" and press "Enter". The terminal is now turned off.

Channel A and/or Channel B Training (in Exchange Terminal only)

Step	Action
1	From Step 4 (Null) above, press "N" until the prompt "Train Channel A" is displayed. Press "Enter" and the display will read "Please Wait" and will then return after a few seconds to the previous prompt, indicating that Channel A has been successfully trained.
2	Press "N" until the prompt "Train Channel B" is displayed. Repeat step 1 above to 'train' Channel B as necessary.
3	Press "Q" to display "Go to sleep" and press "Enter". The terminal is now turned off.

4.11 Selecting the operating frequencies via Hex Codes

It is possible to use any frequencies within the specified operating band plan by selecting the appropriate Hex Code on each Transmitter and Receiver module.

Note: The RF modules (Transmitter, Receiver and Duplexer) do not require further alignment once the correct Codes are selected.

4.11.1 Method

All frequencies and associated Hex Codes for each operating band plan are detailed within Appendix A.

The frequencies are selected using three Hexadecimal switches accessed through holes in the module shroud. Figure 4.10 shows the position of the switches.

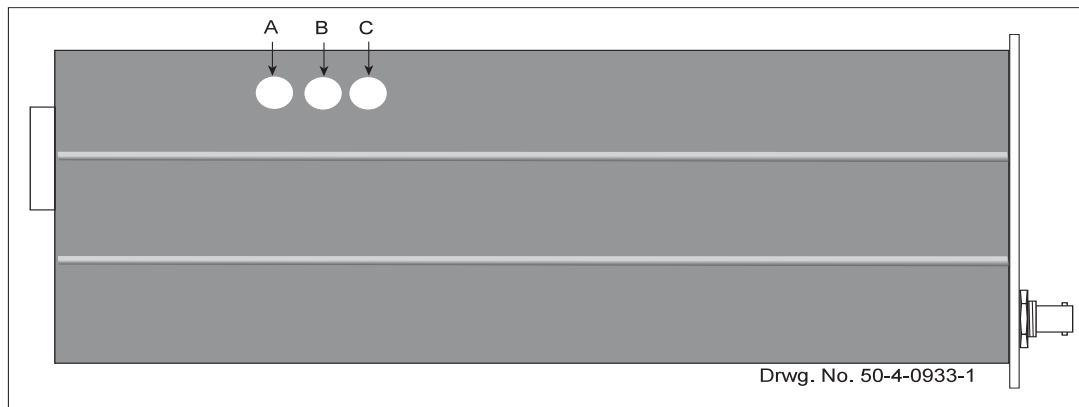


Figure 4.10: Frequency Selection Switches

Key

A Most Significant Bit (PCB reference SW4 in Rx, SW304 in Tx)

B PCB reference SW3 in Rx, SW303 in Tx

C Least Significant Bit (PCB reference SW2 in Rx, SW302 in Tx)

Note: The Hexadecimal switches for each module are immediately accessible upon removal of the wall mount cover. Refer to Section 4.6 for removal details.

4.12 Payphone Interface

The Type 8075 payphone module is designed to interface with a customer's payphone; it is capable of both detecting and generating meter pulse and line reversal signals. This module may be used on the Customer or Exchange terminal.

The 8075 module can be used as a replacement for the earlier 2835 Meter Pulse and the 2854 Line Reversal interfaces.

4.12.1 12 or 16 kHz Meter Pulse

Tone Detection

The FX641 (U203) IC detects 12 or 16kHz meter pulses automatically. Sensitivity may be adjusted in the factory to meet customer requirements. The default setting is 80mV

Tone Generation

This circuit generates a tone at either 12 or 16 kHz for billing. The tone is normally set in the factory to the customer requirement and is not recommended for field-change.

The output level may be adjusted to suit customer requirements to a maximum of 2.9 V RMS. The default level is 2.1V RMS +/- 50 mV

4.12.2 Line Reversal

Detection

The detection circuit is provided via two 4N35 opto-couplers (U113, U114) across a 100 ohm (R120) resistor. This circuit is sensitive down to 12.5 mA

Generation

Relay RL102 (Ch A) and Relay RL101 (Ch B) is used to provide a line reversal.

4.12.3 Payphone Installation and Set-up

To install the Type 8075 Payphone Interface PCB in a wall mount terminal, the wall mount cover must be removed as described in Section 4.6. Mount the payphone interface PCB on the supplied spacers and associated hardware at the front edge of the transmitter module.

Fit the sockets on the end of the ribbon cables to the appropriate payphone plugs on the motherboard PCB. The cable from PL102 on the interface PCB goes to J101 (Payphone A) on the motherboard PCB and the cable from PL101 on the interface PCB goes to J102 (Payphone B) on the motherboard PCB. Replace the wall mount cover.

Software Set-up

Refer to the “Hardware Configuration (Address 8)” in Section 2.11.5 and set the software bit for the “Payphone Fitted” option.

Refer to “Payphone Hold-Up Time” (Address 44) in Section 2.11.3 and set the software byte for the required value.

IMPORTANT NOTE re Payphone Configuration

If a terminal is already configured for Payphone operation and it is to be re-configured for standard 2-wire (non-payphone) operation by removal of the existing payphone interface module(s), 2x jumper links **must** be re-fitted to payphone plugs J101 and/or J102 to allow audio to pass from the 2-wire connector(s) on the chassis to the Line Interface module(s) via the motherboard.

The following pins must be linked to allow 2-wire telephone operation:

J101 (Payphone A) Pins 1-2 (-ve leg) and pins 3-4 (+ve leg)

J102 (Payphone B) Pins 1-2 (+ve leg) and pins 3-4 (-ve leg)

5

Controller Type 8080

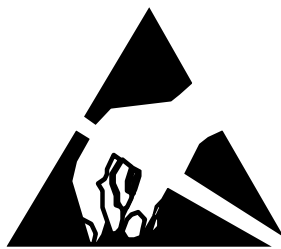
5.1 Introduction

This section provides a brief overview of the controller module. There are no user serviceable parts on this module.

The controller is the core component of the Hawk 2, it contains all the control mechanisms for call setup, call maintenance, and all signal processing for both channel A and B.

The 8080's primary change from the previous 2832 controller is that all line interface components have been moved to the 8087/8088 interface and the DSP has been upgraded to a newer processor and conversion assembly allowing superior line performance.

Functionally the 8080 controller is the same as the 2832.



CAUTION

The semi-conductor components in the Controller and Interface module are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the module should be carried out at "electrostatically safe work stations" where the work bench surface, soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.

5.2 Control Circuitry Description

The heart of the control system is the 89C51 micro-controller (U201). This micro-controller responds to a change of state in the outside world with a pre-programmed response, thus driving the Hawk 2 link through all its modes of operation. The micro-controller communicates with the outside world via the input/output latches, (U208, U209 & U210) and the RS232C port. Internally the micro-controller uses an I²C bus to talk to the EEPROM, analogue to digital converter (ADC) and LCD. Communication with the Digital Signal Processor (DSP) is via an internal data bus.

5.2.1 ADC and Monitoring Switch (U204/U206)

The controller, receiver and transmitter modules each have 8 selectable analogue monitoring points (the switch on the controller is U204). These are selected by the micro-controller using the outputs 0 to 2 on output latch 2 (U210). The monitoring points from these modules are fed into the ADC (U206). The I²C bus is used to select which module the ADC will read and to pass the digitised data back into the micro-controller.

5.2.2 EEPROM

The EEPROM remembers the field adjustable system parameters even when the power has been disconnected for long periods. It communicates these parameters to the micro-controller via the I²C bus.

5.2.3 RS232C Driver

Of the RS232C protocol only transmit (TXD), receive (RXD), ground (GND) lines are used. The receive line is used to wake the controller if data is detected. Because the RS232C driver is powered off to save power when the micro-controller is asleep, the receive line is fed directly to the micro-controller.

5.2.4 Watchdog circuit

As a precaution against software/hardware mishap, the micro-controller repeatedly pulses the watchdog circuitry (U202). If no pulses are being sent, (e.g., a software fault has occurred), then the watchdog will reset the micro-controller.

5.3 Audio Circuitry Description

In order to process the audio signals from channels A and B, the controller converts the analogue audio to digital.

The DSP performs the following functions:

- Conditions the audio for improved data performance
- Integrates Channel A, B and signalling into a single baseband, ready for modulation and vice-versa for the demodulated signal

5.4 Power Supply

In order to reduce the power consumption while in an idle mode, the power supplies have been divided into two sections. The first is a continuous +5 V supply which provides the power to the micro-controller and corresponding circuitry needed to respond to start up condition. The second is a switched ± 5 V and 12 V supply for the remaining circuitry required for the full operation of the controller.

Important Note regarding field-replacement of the 8080 Module

It is important to note that the 8080 Module contains a critical parameter regarding the correct operation of the Rx mute (see non-volatile memory Address # 26, refer Section 2.11.3 for full details)

The value present in Address 26 is directly related to the figure present in RSSI meter reading 'r0' when measured with an Rx input level of -100 dBm (refer to Section 2.6.4 for further details) and will therefore have to be checked and re-entered into Address 26 in the replacement 8080 module to ensure correct mute operation.

Procedure using a Laptop PC or Video Display Terminal

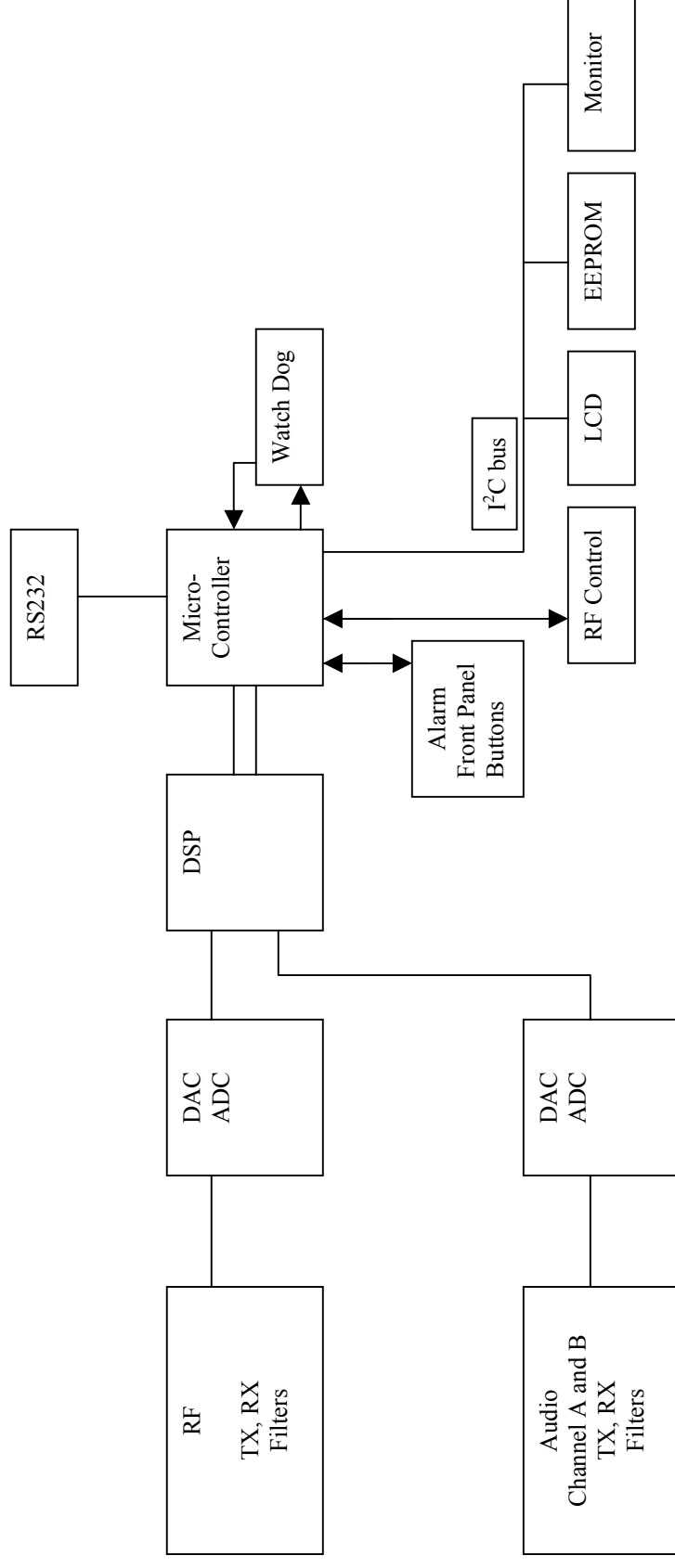
Note: The following instructions assume that the Hawk Terminal has already been removed from its mounting to allow the wall mount cover to be removed (as detailed in Section 4.6) for access to the Receiver module RF input port.

Note also that it is necessary to re-apply DC power to the Terminal to allow Address 26 to be checked/changed.

Connection via RJ45 socket SK106

A Controller to PC cable is available to connect SK106 to the appropriate port on the Laptop PC or VDT. Refer to Section 3.6.10 or Appendix D for pin-out details

Step	Action
1	Remove the Duplexer lead from the Receiver module RF port and connect an RF Signal Generator (set to the appropriate RF frequency at -100 dBm input level). The Rx module should awaken, indicated by the front panel 'Active' LED.
2	The Controller LCD display will immediately show the Local RSSI meter reading 'r0' (as described in Section 2.6.4). For example "0-40" where '0' is the meter position and '40' is the RSSI reading.
3	Take note of the displayed RSSI reading (for entry in Step 9 below) and then remove the signal generator. The Rx module and Controller display will shut down. Re-connect the Duplexer lead.
4	Press any key on the PC or VDT if the screen is blank. This activates the Terminal and display instructions for the wake-up sequence. The <u>Default</u> instruction is for the operator to enter the 'A' key three times.
5	Press "N" on the keypad until the screen displays "Force a Link" (This establishes a Link without requiring the correct Ident Code).
6	Press "Enter". The Terminal will power up and the display will change to show the other terminal's ident code. Press any key to continue.
7	Press "N" on the keypad until the screen displays "Alt L.Sys Param". Press "Enter" and the prompt "Enter Password" is displayed. Key in the password (default is TELSTRA) and press "Enter"
8	The screen will display "Location 008". Enter '26' and then press "Enter". The current value of address 26 will be displayed.
9	Key in the RSSI value obtained in Step 3 above and then press "Enter" to replace the previously stored value. The display will revert to read "Alt L.Sys Param".
10	Press "Q" until the display shows "Go to sleep" and press "Enter" to turn off the local controller.



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6

Exchange Line Interface Type 8087 Subscriber Line Interface Type 8088

6.1 Introduction

The following sections describe the operation of the circuitry within the dual channel line interface PCB. The PCB link settings to configure the line interface for 2-wire or 4-wire plus E and M operation are discussed in Section 4.7 and the setting of line levels is discussed in Section 4.9.

Refer to Figure 6.1 while reading this section.



CAUTION

The semi-conductor components in the Line Interface modules are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the module should be carried out at “electrostatically safe work stations” where the work bench surface, soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.

6.2 Line Interface Circuit Description

The dual channel 8087 Exchange and 8088 Subscriber line interface modules can be operated in two modes: 2-wire and 4-wire plus E and M wires¹

In 2-wire mode, transmit/receive path signals are routed via the Central Office Interface Circuit (COIC) in the 8087 Exchange module, or via the Subscriber Line Interface Circuit (SLIC) in the 8088 Subscriber.

The COIC is used to correctly terminate a central office 2 wire telephone, providing a signalling link and a 2-4 wire line interface between the telephone line and subscriber equipment. The SLIC is used to interface with the subscriber's equipment. The COIC or the SLIC can be configured for TN12 or TN6 impedance.

In 4-wire plus E and M mode, the transmit path signal is routed from the back panel connector of the interface module to the protection devices then to the isolation transformers T301 (Ch A) and T302 (Ch A)²,

¹ The Type 8088 Subscriber Line Interface can provide a 4-wire plus E and M wire Point to Point connection on Channel A ONLY. If Point to Point operation is required on both channels, the 8087 Exchange Line Interface module MUST be used.

² Channel B (Exch and Subs) Isolation Transformer references are T501 and T502.

The operating level of the Type 8087 Exchange transmit path is set via potentiometers RV211 (Ch A) and RV411 (Ch B) in the Type 8087 Exchange and via RV203 (Ch A) and RV403 (Ch B) in the Type 8088 Subscriber.

This is normally adjusted such that 500 mV rms appears at TP202 (Ch A Exch/Subs) and TP402 (Ch B Exch/Subs), when the desired maximum transmit level is applied to the line input (either 2-wire or 4-wire plus E and M). RV202 (Ch A Exch/Subs) and RV402 (Ch B Exch/Subs), sets the desired line receive level.

Note: In 2-wire systems it is important that any path should have a minimum of 3 dB net loss to prevent hybrid instability.

To configure either Dual Channel line interface for 2-wire or 4-wire plus E and M mode, refer to Section 4.7 of this manual. For the line level alignment procedure refer to Section 4.9 of this manual.

6.3 Compandor Circuit Description

The compandor is used to improve the overall noise performance of the Hawk system.

The Channel A compandor transmit path (compressor) circuit for the Type 8087 Exchange is provided by U202B and U201C while for the Type 8088 Subscriber it is provided by U202B and U201D.

The Channel B compandor transmit path (compressor) circuit for the Type 8087 Exchange is provided by U402B and U401C while for the Type 8088 Subscriber it is provided by U402B and U401D.

Q201, Q202 (Ch A Exch & Subs) and Q401, Q402 (Ch B Exch & Subs), provide a peak clipping function.

Each circuit provides a 2:1 dB compression ratio. For example, in the Customer to Exchange direction, a 6 dB change in level at pin 14 U201D (Ch A) or U401D (Ch B) of the Type 8088 Subscriber would be seen as a 3 dB change at pin 8 U201C (Ch A) or U401C (Ch B) of the Type 8087 Exchange.

In the Exchange to Customer direction, a 6 dB change in level at pin 8 U20CD (Ch A) or U401C (Ch B) of the Type 8087 Exchange would be seen as a 3 dB change at pin 14 U201D (Ch A) or U401D (Ch B) of the Type 8088 Subscriber.

The compandor receive path (expander) is provided by U201B, U202A (Ch A Exch & Subs) & U401A, U401B (Ch B Exch & Subs). This circuit provides a 1:2 dB expansion ratio.

For the correct procedure for adjusting line levels refer to Section 4.9 of this manual.

Note: When single tone testing techniques are used, systems using compandors appear to have a doubling of frequency response error. This apparent doubling of response errors is a result of the expander rectifier being sensitive to the peak voltage of the receiver audio signal. A typical voice signal has dominant energy about a 1 kHz centre frequency. The energy at the frequency extremes 300 to 500 Hz and 3.2 to 3.4 kHz has little contribution to the expander rectifier output. Under dynamic voice operation the expander gain is controlled by the dominant centre band energy, and the frequency response is the same as without companding.

6.4 Two Wire Line Control Circuits

The line interface is used to interface the Hawk to the PSTN or to the subscriber's telephone, by detecting/generating the normal telecommunication states of telephone off/on hook, ringing generators/detectors, and line current generators/detectors. All functions are controlled via the COIC/SLIC and controller micro.

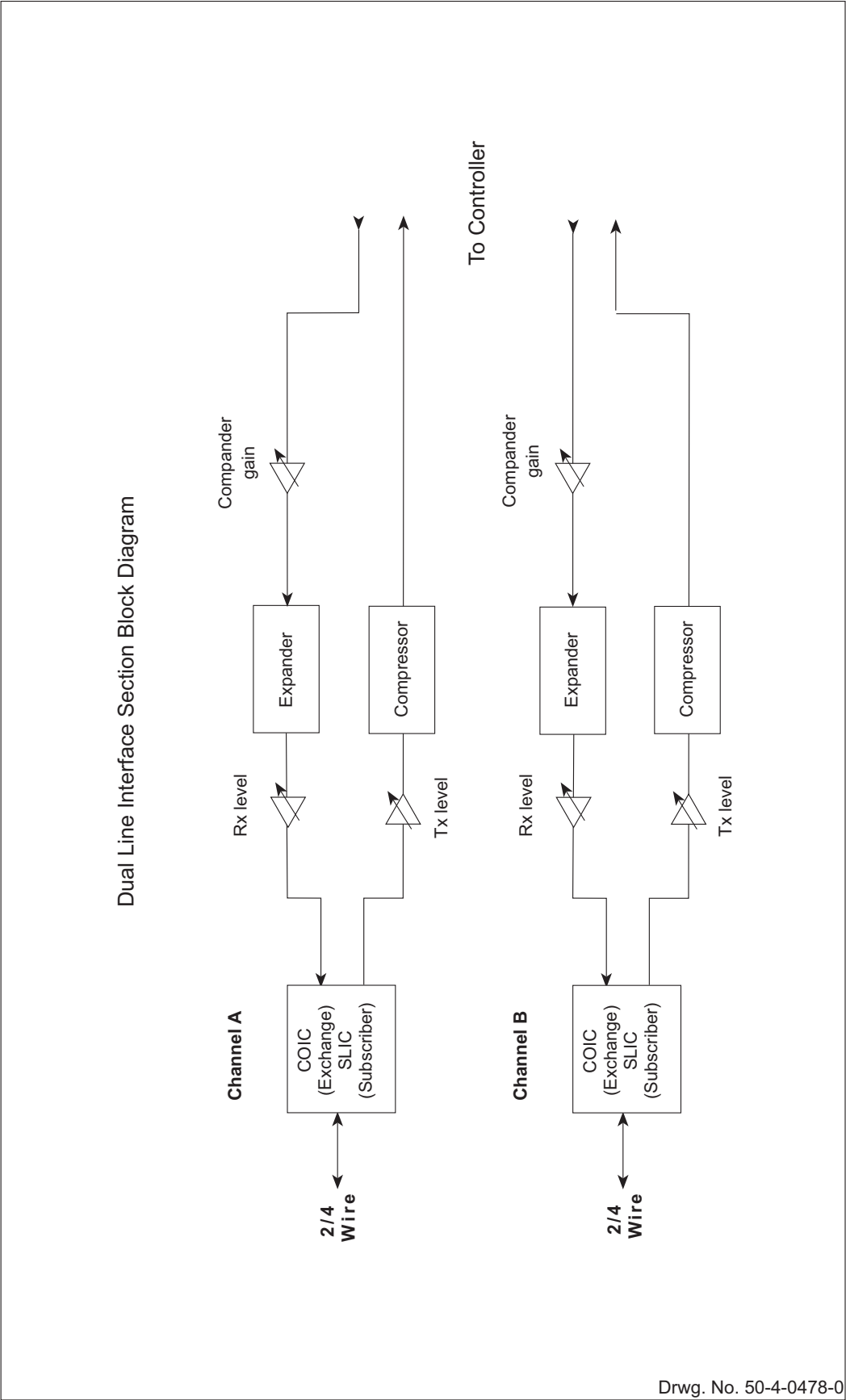


Figure 6.1 Interface Block Diagram

7

Duplexer Type 2824

7.1 Introduction 2824 UHF Duplexer

This Duplexer Module is used to enable the transmitter and receiver modules in a Hawk terminal to use the same antenna. Each duplexer covers a specific band of frequencies and may be tuned to any frequency in that band as required¹

Each duplexer comprises two notch filters, one low pass, and the other high pass. Refer to Figure 7.1.

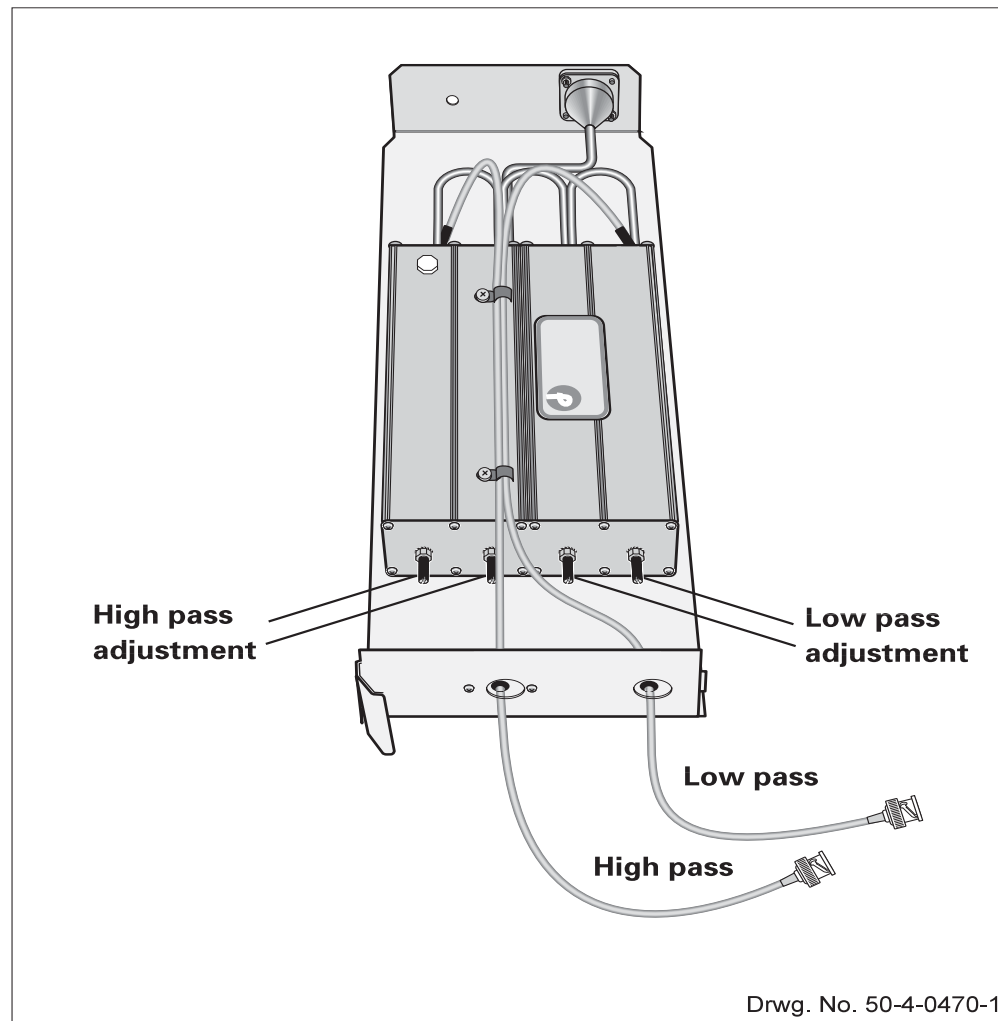


Figure 7.1 UHF Duplexer Alignment Points

¹ Note that the Duplexer modules are pre-aligned to the centre frequencies of the desired operating band – Refer to Section 7.3.1 for further details.

The low pass filter is tuned to provide a notch at the higher frequency used by the terminal, and the high pass filter is tuned to provide a notch at the lower frequency used by the terminal. The intention is to exclude the transmitter frequency and any wideband transmitter noise at the receiver frequency from the receiver port.

**CAUTION**

The Duplexer Module is not a field serviceable item. In case of a fault occurring, it should be replaced rather than repaired.

When the duplexer module is correctly inserted into position, the N-type connector on the rear of the module protrudes from the outward facing side of the motherboard. The two BNC terminated leads from the front of the duplexer module are each connected to the BNC connectors on the front of the receiver and transmitter modules.

7.2 Specifications

Type	Bandstop - bandstop, 4 cavity resonator
Antenna	Type N female
RF Modules	Highpass (HP) and lowpass (LP) connections, BNC male on flying leads
Bands Covered (MHz) ¹	138-148, 148-162, 159-174, 403-423 , 410-430, 430-450, 450-470 , 470-500, 490-512
Max Input Power	50 Watts
Temperature Range	-30°C to +60°C
Humidity Range	0 - 95% non-condensing.
Insertion Loss	1.5dB Max HP port to antenna or LP port to antenna (dependent on Tx - Rx separation)
Tx Noise Suppression at Rx Frequency	60dB minimum
Rx isolation at Tx Frequency	60dB minimum.
Antenna Port Return Loss	10dB minimum (dependent on Tx - Rx separation)
HP, LP Port Return Loss	10dB minimum (dependent on Tx - Rx separation)
Tx - Rx Separation 138 - 174MHz sub-bands 403 - 512MHz sub-bands	4.5 to 10.0MHz 5.0 to 10MHz

¹ **Bold** RF bands only to be supplied to Telstra.

7.3 Alignment Procedure

This Duplexer module has sufficient bandwidth to cover the desired operating band without further alignment if the associated Transmitter and Receiver modules are changed in frequency.

7.3.1 Duplexer Module Default Frequencies

The Duplexer module within each Hawk Terminal will always be set to the centre-band frequencies shown in the table below:

Operating Band Plan	Tx Low (Exchange)	Tx High (Customer)
400 MHz	404.5000 MHz	413.9500 MHz
450 MHz	451.0000 MHz	460.5000 MHz

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7.4 Introduction 61-2824-05009 VHF Duplexer

This Duplexer Module is used to enable the transmitter and receiver modules in a Hawk terminal to use the same antenna. Each duplexer covers a specific band of frequencies and may be tuned to any frequency in that band as required¹

Each duplexer comprises two notch filters, one low pass, and the other high pass. Refer to Figure 7.2.

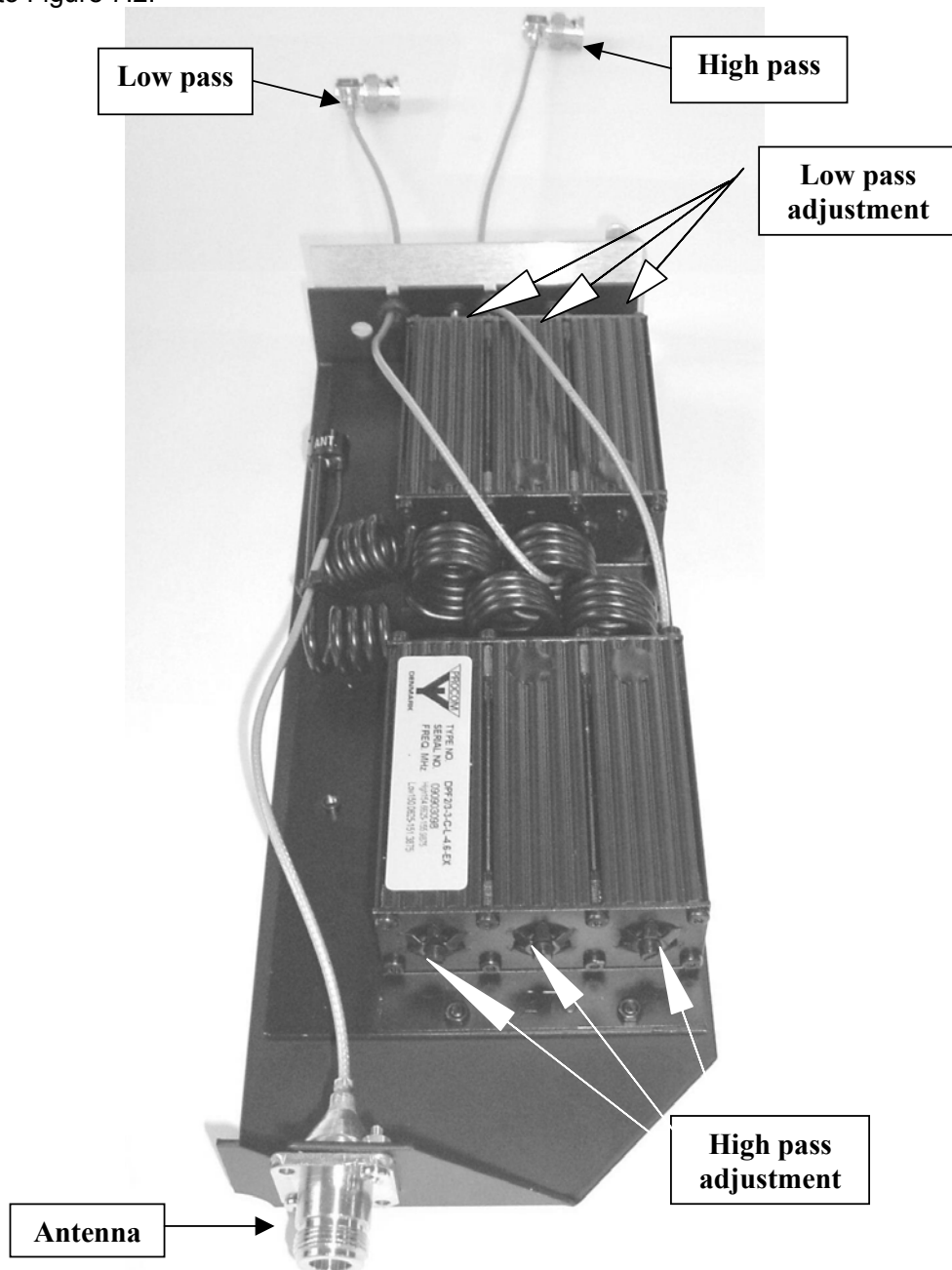


Figure 7.2 VHF Duplexer Alignment Points

¹ Note that the Duplexer modules are pre-aligned to the centre frequencies of the desired operating band – Refer to Section 7.6.1 for further details.

The low pass filter is tuned to provide a notch at the higher frequency used by the terminal, and the high pass filter is tuned to provide a notch at the lower frequency used by the terminal. The intention is to exclude the transmitter frequency and any wideband transmitter noise at the receiver frequency from the receiver port.

**CAUTION**

The Duplexer Module is not a field serviceable item. In case of a fault occurring, it should be replaced rather than repaired.

When the duplexer module is correctly inserted into position, the N-type connector on the rear of the module protrudes from the outward facing side of the motherboard. The two BNC terminated leads from the front of the duplexer module are each connected to the BNC connectors on the front of the receiver and transmitter modules.

7.5 Specifications

Type	Bandstop – bandstop, 6 cavity broadband notched resonator
Antenna	Type N female
RF Modules	High-pass (HP) and low-pass (LP) connections, BNC right angle male on flying leads. Leads are identified “HP”, “LP”.
Bands Covered (MHz)	150MHz-156MHz
Max Input Power	30 Watts
Temperature Range	-30°C to +60°C
Humidity Range	0 - 95% non-condensing.
Insertion Loss: at centre frequency $\pm 700\text{kHz}$	Max 1.5dB, Tx port Max 1.5dB, Rx port
Port Isolation (notch performance) at centre frequency $\pm 700\text{kHz}$	>65dB on Rx port >65dB on Tx port
Antenna Port VSWR	2.1 max.
HP port to Ant, LP port to Ant VSWR	2.1 max
Tx - Rx Separation	4.6MHz

7.6 Alignment Procedure

The Duplexer module has sufficient bandwidth to cover the desired operating band without further alignment if the associated Transmitter and Receiver modules are changed in frequency.

7.6.1 Duplexer Module Default Frequencies

The Duplexer module within each Hawk Terminal will always be set to the centre-band frequencies shown in the table below:

Operating Band Plan	Tx Low (Exchange)	Tx High (Customer)
150 MHz	150.7250 MHz	155.3250 MHz

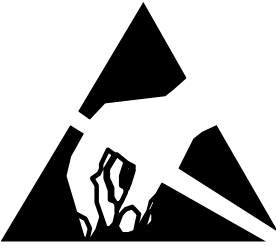
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8

UHF Receiver Type 2940

8.1 Introduction

This section describes the detailed operation of the circuitry within the receiver module and the frequency selection procedures.

 CAUTION	The semi-conductor components in the UHF Receiver module are sensitive to electrostatic damage. Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the module should be performed at "electrostatically safe work stations" where the work bench surface; soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.
 CAUTION	The ferrite core slugs used in the equipment are mechanically fragile and require correctly fitting tools for adjustment. In addition, these slugs can be damaged permanently by strong magnetic fields, so the use of magnetic tools must be avoided.

8.2 Specifications

Receiver Type	Synthesised dual conversion, superheterodyne
Frequency Bands (MHz)	403-423 , 410-430, 430-450, 450-470 , 470-490, 480-500, 490-512 (Bold RF bands only to be supplied to Telstra)
Channel Spacing Dual Channel	25 kHz
Modulation Type Dual Channel	25K0F9WWF
Synthesiser Step Size	5 kHz or 6.25 kHz (6.25 kHz is default)
Input Impedance	50 Ω nominal
Limiting Characteristics	< 3 dB output change for input -107 dBm to -7 dBm
Spurious Responses	>70 dB

Conducted Spurious Emissions	<-57 dBm	
Intermodulation	>70 dB (typically 75 dB)	
Blocking	>-23 dBm	
Maximum Rx attack time¹ (Typical measurements only)	Non-cycling configuration	0.6 ms
	Cycling configuration	55 ms
	Quick start configuration	42 ms
Maximum Rx signal valid² (Typical measurements only)	Non-cycling configuration	25 ms
	Cycling configuration	150 ms
	Quick start configuration	30 ms
Frequency Stability	2.5 ppm TCXO	
Environmental	Operates within -30 °C to +55 °C, up to 95% relative humidity, non-condensing	
Maximum DC Supply Current at 13.8 VDC input (Typical measurements only)	Standby, non-cycling configuration	120 mA
	Standby, cycling configuration	75 mA
	Receiver established	125 mA

Dual Channel Operation in a 25 kHz Band Plan

IF Filter Bandwidth	22 kHz
Usable Sensitivity	>12 dB SINAD for -116 dBm RF input, 3 kHz deviation, 1 kHz modulation frequency.
Selectivity	>70 dB (25 kHz channel spacing)
Frequency Response 100 Hz to 300 Hz 300 Hz to 8.2 kHz	± 1 dB ± 0.5 dB
Audio Distortion	< 3% unweighted
Ultimate Signal to Noise	Weighted >50 dBp at -70 dBm RF input (relative to 3 kHz deviation), unweighted 40 dB

¹ With DC applied continuously to the receiver, the delay between application of modulated RF to the Rx input and demodulated 90% of final amplitude audio appearing at the audio output of the Rx

² With DC applied continuously to the receiver, the delay between application of modulated RF to the Rx input to the signal valid output appearing at the Rx output.

8.3 Receiver Circuit Description

8.3.1 General

The receiver is a dual conversion heterodyne type. The first intermediate frequency (IF) is 21.4 MHz with the second IF being 455 kHz. The first IF is synthesised; the second is crystal controlled.

8.3.2 RF Input Protection

The input of the receiver has diode protection that provides low impedance to incoming levels in excess of 10 mW and hence provides some reflection of high incoming energy. In addition, Q404 clamps low when RF levels in excess of 10 mW appear at the receiver, and pulls the transmitter power low via pin 5 of the rear plug on the receiver module. This is to protect against possible excess transmitter power appearing at the receiver input, e.g. during frequency adjustments in the field.

8.3.3 RF Amplifier and First Mixer

The RF amplifier Q401 and the mixer Q402 are both dual gate MOSFET. Q401 provides low noise with sufficient gain to ensure good noise performance for the entire receiver without degrading large signal performance. The helical resonators T401 and T402 provide front-end selectivity. The second oscillator buffer Q403 feeds synthesised oscillator injection from the VCO, and first buffer Q201, to gate 2 of Q402. The resulting IF difference frequency is selected by T500 and T501.

8.3.4 21.4 MHz Filter and Amplifier

Adjacent channel selectivity is provided by two crystal filters FL501 (and associated components T501, T502, R503 and R504) and FL502 (and associated components T503, T504, R509 and R510)

There are two identical IF amplifier stages, utilising dual gate MOSFETs to provide sufficient gain to limit the following IF stages, and also provide good noise performance.

The first IF amp consists of Q502 and associated components R506, R507, R508, C503, C504 and C505; the second IF amp consists of Q503 and associated components R511, R512, R514, C508, C506 and C507.

8.3.5 Second Mixer and Oscillator

This mixer and oscillator reside within U500. The oscillator is crystal controlled using X1 at 20.945 MHz. providing a difference frequency from 21.4 MHz of 455 kHz. This is selected by T506.

8.3.6 455 kHz Limiter and Discriminator

U501 incorporates two limiting IF amplifiers, quadrature discriminator, muting, logarithmic Receiver Signal Strength Indicator (RSSI) and voltage regulator. T507 provides some attenuation of wide band IF noise and is inserted between the two limiting amplifiers residing within U501. U501 provides two audio outputs. The main audio output is taken via pin 6, and is mute controlled by pin 3. The output via pin 7 is not mute controlled and is used for wide band data, and as the noise output for the signal valid detection circuitry. DC shift for AFC is derived differentially from pin 6 and pin 7 outputs.

Note: AFC is only used for alignment purposes, and is not used for normal receiver operation.

8.3.7 Audio Amplifier

Audio from pin 6 of U501 is buffered using Q504, and fed through the audio level adjustment RV1 to the low noise op amp U700B. Audio output impedance is a nominal 600 Ω , controlled by R718. The audio output is referenced to the analogue ground provided on pin 20 of the module rear plug.

8.3.8 Receiver Signal Strength Indicator (RSSI)

Pin 5 of U501 provides RSSI, a varying DC voltage that is logarithmically proportional to the received RF signal strength. Q505 buffers the output of pin 5, and feeds it to pin 13 of U17, where it is used to give an indication of received signal strength.

Note: The RSSI facility is mainly used for alignment purposes.

8.3.9 Signal Valid Indication/Low Signal Alarm

The receiver provides a signal valid indication to the front panel LED, and a binary output to pin 17 of the module rear plug. The audio output UNMUTE AF from pin 7 of U501 is buffered via Q600, amplified with Q601 and detected with D606 and D607. This noise voltage is filtered via L600 and C615, with threshold adjustment provided by RV3 feeding comparators U601A and U601B after detection. The derived DC voltage is proportional to the high frequency noise of the receiver.

The signal valid threshold is normally set at 20 dB SINAD. U601A provides the signal valid output /SV to pin 17 of the rear plug. U601B provides an alarm output S/N ALARM that operates at SINAD approximately 6-8 dB above the signal valid threshold. The binary alarm output fed to pin 18 of the rear plug is logic "high" in alarm condition (i.e. SINAD less than 28 dB). The noise voltage is made available to pin 14 of U17 for monitoring (refer to Section 8.3.13)

8.3.10 Frequency Synthesiser Circuitry

When the receiver is powered-up, the three parallel to serial converters, U303, U304 and U305 receive inputs from the resistor programming network (comprising R770-R777 inclusive) and the Hexadecimal frequency select switches, SW2, SW3 & SW4.

Resistor Programming Network

The resistor programming network sets the relevant operating frequency band of the receiver (the three Hexadecimal switches select the actual frequency channel that the receiver will operate at)

The table below shows the selection of the relevant operating frequency band via the resistor programming network.

Note: The relevant operating frequency band will have been selected during manufacture. It is not likely that this would need to be selected after delivery.

RF Band (MHz)	R777	R776	R775	R774	R773	R772	R771	R770
403-423	ON	ON	OFF	OFF	OFF	ON	ON	OFF
450-470	ON	ON	OFF	OFF	ON	ON	ON	ON

The inputs from the switches are fed in parallel to U303, U304 and U305, and are then “clocked” serially to pin 12 of the micro-controller U302. The twenty-four clock pulses required by U303, U304 and U305 are generated by U302. R306 is fitted only if down conversion is required.

The synthesiser step size is set to 6.25 kHz (SL301 is not bridged). U302 uses this input and the data it receives on pin 12 to derive the frequency data sent to U307. U307 then uses this data, the input to pin 8 (SYNTH RF output from the VCO), and the input to pin 1 (output from the reference oscillator, X301) to derive the input to the operational amplifier U308. The output from U308 is used to derive LOOP_V and the tuning input to the VCO, VCOTUNE.

The output from pin 7 on U307 is fed back to U302 to indicate whether U307 has successfully “locked” to the required frequency. When U307 has achieved frequency lock, U302 takes the output /LOCK DETECT from pin 17 low.

8.3.11 Reference Oscillator

This comprises X301, a 9.60 MHz TCXO. A trimmer on X301 can be adjusted so that it provides exactly 9.600000 MHz.

8.3.12 Voltage Controlled Oscillator (VCO)



CAUTION

The receiver VCO is **NOT** field serviceable. Repairing and testing of the VCO is best done in the factory.

The VCO contains the resonator, oscillator and frequency control varicap, in a factory enclosed assembly. The VCO is tuneable via a trimmer that is accessible through the top of the shield. The tuning signal for the VCO, VCOTUNE is derived in the Frequency Synthesiser circuitry. The output VCOOUT is fed to the first stage buffer Q201, then the low pass filter, then via PL201 to the oscillator buffer Q403 for use in the first mixer.

8.3.13 Monitor Facilities

Seven monitor inputs are examined with the aid of a 1 of 8 analogue multiplexer U17. Any one of these inputs may be selected to be available at the module rear plug pin 15. These are selected by a binary number fed into the module rear plug pins 2, 13, and 14.

This binary coded decimal (BCD) number may be selected and displayed on the Type 8080 Controller module front panel (refer to Section 2.6.4).

The analogue monitor inputs, together with their BCD and associated pins on U17, are shown below. The selected output appears at pin 3 of U17.

BCD	Output	Pin No. on U17
0	Receiver Signal Strength Indicator (RSSI)	13
1	Noise Voltage	14
2	Lock Detected	15
3	Loop Voltage	12
4	Wide Band Audio	1
5	Not Used	5
6 ¹	AFC	2
7	Power Control	4

¹ AFC is only used during the module alignment procedure; it is not used for normal receiver operation.

8.3.14 Power Supplies

The receiver has two separate 10 V supplies. The supplies are run off each half of U13, and both are commonly referenced to U701.

The first supply (consisting of components Q701, Q702, U13A etc) provides +10V to the majority of the receiver circuitry via the **+10VSW** supply line.

The second supply (consisting of components Q761, Q762, U13B etc) provides +10V to the VCO and 1st Buffer (via the **+10V** supply line) and +5V to the TCXO, Loop Filter and microprocessor circuitry (via the **+5V** supply line generated by the regulator U309)

Quick Start Configuration

The second power supply is usually switched together with the first power supply. In certain applications, the second power supply can be permanently switched on to provide a Quick Start configuration to allow a reduction in synthesiser lock time.

Quick Start configuration can be enabled by removing the 10 Ω resistor from location R768 and placing across the usually empty location R769.

8.4 Receiver Frequency Selection

8.4.1 General

It is possible to use any valid frequency within the specified operating band plan (403-423 MHz or 450-470 MHz) via selection of three Hexadecimal switches accessed through holes in the module shroud.

Note: The Receiver module does not require further alignment once the correct Codes are selected within the specified operating band plan.

The Hexadecimal switches are immediately accessible upon removal of the wall mount cover. Refer to Section 4.6 for removal details.

Figure 8.1 shows the position of the switches

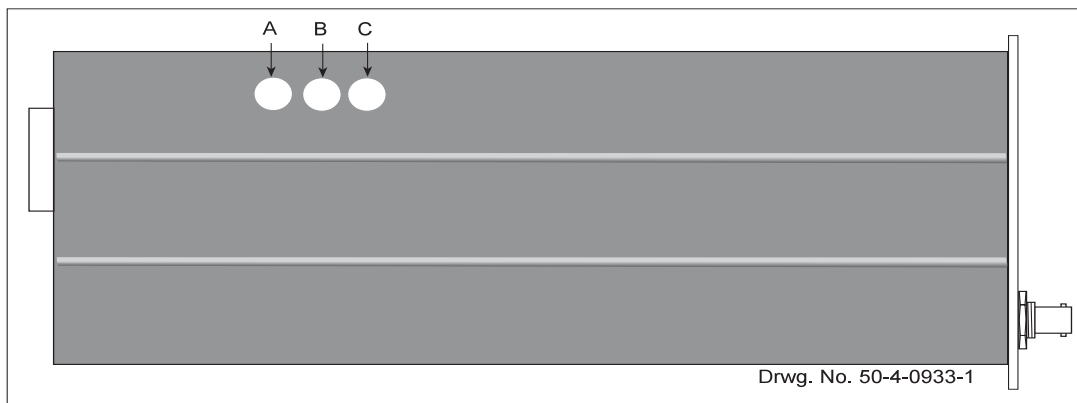


Figure 8.1: Frequency Selection Switches

Key

- A** Most Significant Bit (PCB reference SW4)
- B** PCB reference SW3
- C** Least Significant Bit (PCB reference SW2)

Note: The selected receive frequencies are restricted to those with 6.25 kHz synthesiser increments (SL301 is not bridged on the module PCB)

8.4.2 Operating Frequency Charts

All valid frequencies and associated Hex Codes for each operating band plan are detailed within Appendix A, with default frequencies shown in **bold** text.

The relevant operating band plan is also provided underneath the wall mount cover. Refer to Section 4.6 for removal details.

Refer to the relevant chart as necessary to determine the correct Hex switch setting for the desired operating frequency.

8.4.3 Calculation Method

The Hex switch setting can be confirmed if necessary by the following process:

$$\text{Switch Setting} = \text{Hex} \left[\frac{\text{Required freq. (MHz)} - \text{start freq. (MHz)}}{\text{Synthesiser Step Size (MHz)}} \right]$$

Example:

Start frequency = 450.000 MHz (450 to 470 MHz band receiver)
 Required frequency = 460.375 MHz
 Synthesiser Step Size = 6.25 kHz

Step 1

Calculate Decimal Number (base 10)

$$\frac{460.375 - 450.0}{0.00625} = 1660$$

This number represents the total number of 6.25 kHz steps above the start frequency necessary to achieve the required receive frequency.

Step 2

Convert 1660 to a hexadecimal number to suit the frequency selection switches:

$$1660 \div 256 = 6.484375.$$

6 is a whole number so this is the correct setting for SW4 (MSB)

Step 3

Multiply the remainder (0.484375) by 256 = 124.

$$124 \div 16 = 7.75.$$

7 is the correct setting for SW3.

Step 4

Multiply the remainder (0.75) by 16 = 12.

12 is a whole number, use the table below to convert 12 to the correct Hexadecimal setting.

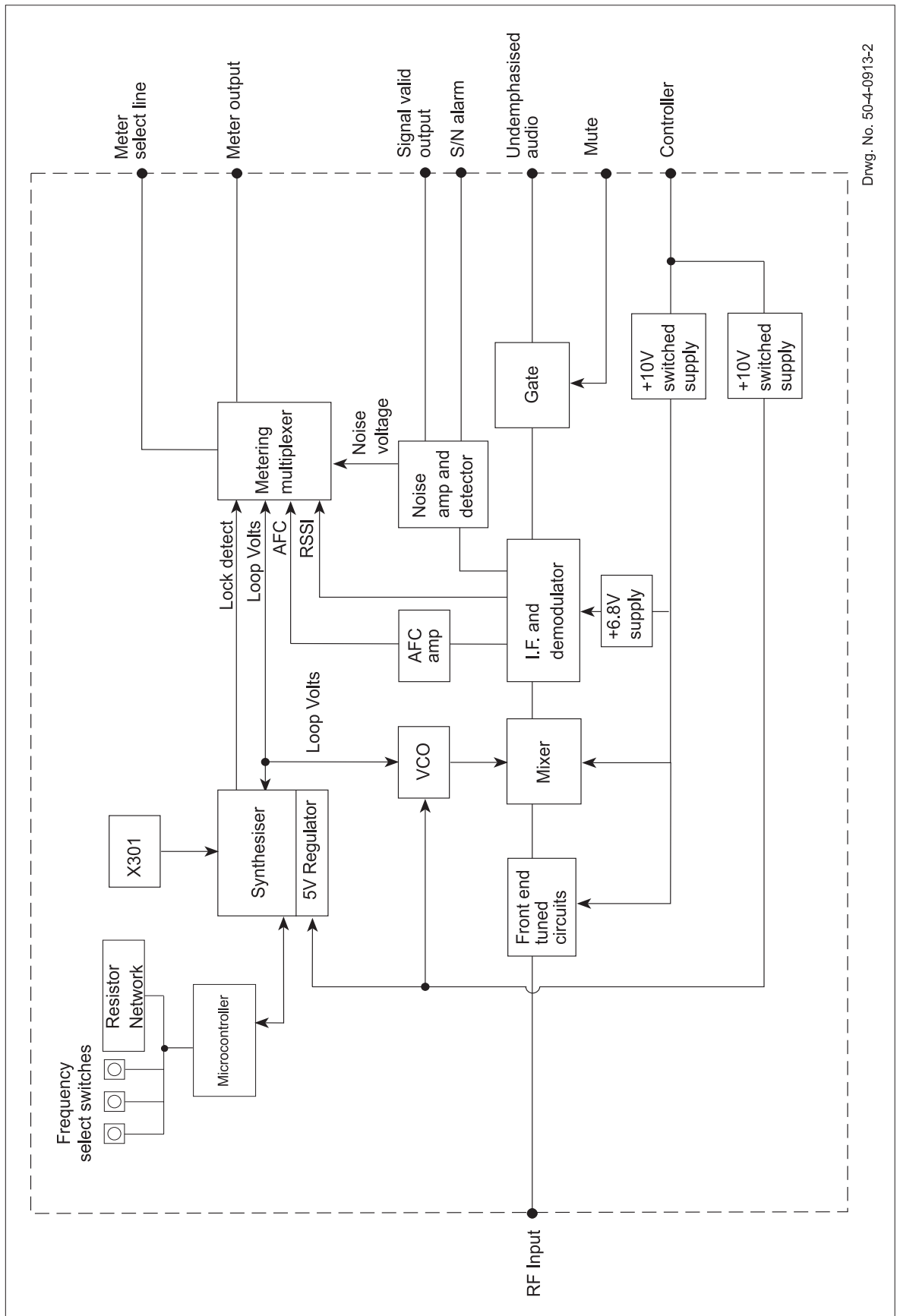
Hex Digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

C is the correct setting for SW2 (LSB)

Note: If the final figure is not a whole digit you have made an error in your calculations, or you have attempted to set a frequency which is not in the 5.0 or 6.25 kHz channel spacing band plan, and therefore not allowable.

Conversion complete 1660 = **67C** Hexadecimal (base 16)

This setting of the Hexadecimal Switches will produce the required frequency of 460.375 MHz for a receiver in the 450 - 470MHz band with 6.25 kHz channel spacing



Drwg. No. 50-4-0913-2

Figure 8.2: Receiver Block Diagram

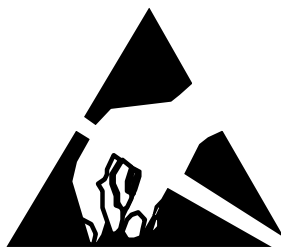
10

UHF Transmitter Type 2950

10.1 Introduction

The transmitter is synthesiser driven and direct frequency modulated.

Minimal audio processing occurs in the transmitter module. It is intended that this takes place in the Type 8080 Controller Module.



CAUTION

The UHF Transmitter module contains semi-conductor components that are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the modules should be performed at “electrostatically safe work stations” where the work bench surface; soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.



CAUTION

The RF devices used in the transmitter module (for example, the RF Power output module) may contain beryllium dioxide. These devices must not be broken, ground, hammered or tampered with in any way, and should be disposed of in a safe manner as specified in local environmental and safety legislation. If safe disposal is a problem, they should be sealed in an appropriate container and returned to Exicom for disposal. In this case, it is the senders' responsibility to ensure that all precautions are taken to ensure safe delivery to Exicom.

10.2 Specifications

Transmitter Type	Synthesised with direct frequency modulation
Synthesiser Step Size	5 kHz or 6.25 kHz (6.25 kHz is default)
Frequency Bands (MHz)	403-423 , 410-430, 430-450, 450-470 , 470-490, 480-500, 490-512 (Bold RF bands only to be supplied to Telstra)
Output Impedance	50 Ω
RF Output Power	Below 470MHz, 1 W to 15 W (adjustable) Above 470MHz, 1 W to 13 W (adjustable)
RF Power Regulation Over specified bandwidth With Supply Voltage With Temperature	± 0.5 dB ± 1 dB for 10.6 V _{DC} to 15.5 V _{DC} ± 1 dB for -30 °C to +55 °C
Duty Cycle	100% from -30 °C to +55 °C up to an altitude of 3000 m
Frequency Stability	± 1.0 ppm from -30 °C to +55 °C and with a supply voltage of 10.6 V _{DC} to 15.5 V _{DC}
Spurious Outputs	< 0.25 μ W (-36 dBm) from 100 kHz to 4 GHz
Adjacent Channel Power	<-25 dBm for 25 kHz Channel Spacing
VSWR Protection	Withstands VSWR of 20:1 at any phase angle
Thermal Protection	Integral. RF output power automatically reduced when module heatsink temperature reaches 95 °C ± 5 °C
Modulation Distortion Deviation	Direct frequency modulation <1.0% at 3 kHz deviation weighted Adjustable 1.5 kHz to 5 kHz
Modulation Input Impedance	Hi "Z" (36 k Ω) differential input
Modulation Input	775 mV _{rms}
Audio Frequency Response	± 0.3 dB from 300 Hz to 8.2 kHz with DC response option
Hum and Noise	>39 dB unweighted wide band
Transmitter Switching Bandwidth	20 MHz for 403 to 512 MHz bands.
Residual AM	<0.5%
Carrier Leakage	<-65 dBm
Environmental	Operates within -30 °C to +55 °C, up to 95% relative humidity, non-condensing
Operational Voltage Range	10.6 V _{DC} to 15.5 V _{DC}

Maximum DC Supply Current at 13.8 VDC input (Typical measurements only)	Standby, non-fast key configuration	15 mA
	Standby, Fast Key configuration	110 mA
	Tx keyed, 1 Watt output from Duplexer (approx. 1.3 W from Tx)	1.2 A
	Tx keyed, 10 Watts output from Duplexer (approx. 13 W from Tx)	3.0 A
Maximum Tx key up delay¹ (Typical measurements only)	Non-fast key configuration	100 ms
	Fast Key configuration	3.0 ms

10.3 Circuit Description

The following section provides a detailed description of the operation of the circuit.

10.3.1 Voltage Controlled Oscillator (VCO) and Modulator



The transmitter VCO is **NOT** field serviceable. Repairing and testing of the VCO is best done in the factory.

The VCO contains the resonator, oscillator and frequency control varicap, in a factory-enclosed assembly. The VCO is tuneable via a trimmer that is accessible through the top of the shield.

10.3.2 Frequency Synthesiser Circuitry

When the transmitter is powered-up, the three parallel to serial converters, U303A, U304A and U305A receive inputs from the resistor programming network (comprising R770-R777 inclusive) and the Hexadecimal frequency select switches, SW302, SW303 and SW304.

Resistor Programming Network

The resistor programming network sets the relevant operating frequency band of the transmitter (the three Hexadecimal switches select the actual frequency channel that the transmitter will operate at)

The table below shows the selection of the relevant operating frequency band via the resistor programming network.

Note: The relevant operating frequency band will have been selected during manufacture. It is not likely that this would need to be selected after delivery.

¹ Delay from “key up” signal input to 50% power present at the RF output connector

RF Band (MHz)	R777	R776	R775	R774	R773	R772	R771	R770
403-423	ON	ON	OFF	OFF	OFF	ON	ON	OFF
450-470	ON	ON	OFF	OFF	ON	ON	ON	ON

These parallel inputs are fed or “clocked” serially to pin 12 of the microcontroller U302. The twenty-four clock pulses required by U303A, U304A and U305A are generated by U302.

The synthesiser step size is set to 6.25 kHz (SL301 is not bridged). U302 uses this input and the data it receives on pin 12 to derive the frequency data sent to the Phase Locked Loop IC U307. U307 compares the output from the VCO on pin 8 with the TCXO signal on pin 1 to derive the VCO control signal, which it outputs on pin 5.

The signal is then filtered by the loop filter operational amplifier U308A. The output signal from the filter, VCOTUNE, controls the VCO and can be monitored on TP301.

U307 also sends status information from pin 7 to U302, which indicates whether U307 has successfully “locked” to the required frequency. When U307 has achieved frequency lock, U302 takes pin 17 low. The output from pin 17 is the LOCK_DET signal; this can be monitored on TP403.

10.3.3 Reference Oscillator

This comprises X301, a 9.60 MHz TCXO. A trimmer on X301 can be adjusted so that it provides exactly 9.600000 MHz.

10.3.4 VCO Supply

U401 is a switching regulator that inverts its supply voltage when used with C405 and C407. This voltage is applied to bias the VCO and the audio stage.

10.3.5 Audio Line Input and Level Control

Balanced audio input of 775 mV_{rms} (for nominal deviation) is applied to pins 8 and 20 (SK101) which is protected against Electromagnetic Interference (EMI) by the inductor capacitor filters (L106, L107 and C125, C126, C128 and C129). This signal is applied to U101D, which provides common mode rejection against external hum and noise at the two-wire line input. This voltage may be monitored at TP102 and TP104.

The test point TP107 may be used for fault tracing, with an oscilloscope. A 775 mV_{rms} sinewave at this point should cause 3 kHz of FM deviation.

Audio limiting and filtering is external to the transmitter.

10.3.6 RF Driver

Q501 a dual gate FET and Q502 form a broad band RF amplifier with 30 dB gain and 400 mW output capability. Gate 2 of Q501 regulates the transmitter output power by adjusting the stage gain.

The input to Q501 is via C501, L508 and L501. These components form an impedance matching network; similar matching is used between Q501 and Q502. Output matching to 50 Ω is performed by a modified pi network C523, C527, C528 and L509. All of these networks are relatively low Q giving 1dB bandwidths of at least 40 MHz at UHF frequencies.

10.3.7 RF Power Amplifier

The power amplifier consists of a broad band hybrid power module. RF drive is fed to the power amplifier via a coaxial cable. U601 is supplied with 10 V on pin 2 and 12 V on pins 3 and 4. Thermal protection is given by U653 (refer to Section 10.3.11).

10.3.8 Dual Directional Coupler

Output of the power amplifier module is fed via a low pass elliptical filter to the dual directional coupler. This provides sample voltages for forward and reflected power, which are used to give an indication of the VSWR of the transmitter load. The forward power voltage is also used in the power control loop to keep the transmitter output power constant.

10.3.9 High Pass Filtering

The RF output from the power amplifier module is also fed to an absorptive high pass elliptical filter. This keeps the harmonic energy to a minimum.

10.3.10 RF Power Output Control

Voltage from the forward power port of the dual directional coupler feeds the constant output power loop. The loop consists of U702B and Q501 with RV701 enabling the transmitter output power to be adjusted from 1 W to 15 W.

As the voltage at the forward power port of the dual directional coupler increases, the voltage on Gate 2 of Q501 is reduced by the control loop and so the transmitter output power is reduced (and vice versa). This keeps the output power constant for supply voltage variations.

By grounding the base of Q702 through D710 at pin 5 of the rear panel socket (thus interrupting the constant power loop), the power output can be reduced externally, e.g. from the receiver module when the receiver is overloaded.

10.3.11 Thermal Protection of the RF Power Amplifier Module

U653 is mounted on the flange of U601 and increases its output voltage at a rate of 10 mV/°C. When its output reaches 950mV (indicating a heatsink temperature of 95°C); it turns Q701 on, which reduces Q702 emitter voltage. This controls the operation of the output power control loop reducing the power output of the transmitter until thermal equilibrium is reached.

10.3.12 VSWR Alarm

The forward and reflected power voltages from the dual directional coupler are fed to a differential amplifier U702/A via two logarithmic elements contained in D703. The output of U702A is thus a function of VSWR and is fed to the monitor. Q704 switches the VSWR ALARM and its threshold is set by RV702.

10.3.13 Audio and Synthesiser Power Supply

This 10 V supply is based on U152, which uses a 4 V reference, set up by R151 and R152. This is compared to a feedback voltage and varies the conduction of Q152 via Q151 to maintain 10 V. U151 is an unswitched 8 V regulator that supplies U152B and the 4 V reference. U152A is switched on at Tx power up and may be permanently powered up by the “fast key” shunt PL151. This provides for faster Tx activation as the synthesiser is maintained powered on and in a locked state.

10.3.14 RF Power Supply

This 10 V supply has the same operation as the audio and synthesiser power supply. It is only switched on when the synthesiser is locked and the transmitter enabled, being switched via R655 by a low on the RF_EN line. Q652 is able to supply the higher current demands of pin 2 of U601 and the driver stage.

D603, a red LED on the module front panel, indicates when the RF power supply is enabled. This only occurs when synthesiser lock is established and the Tx_key line is pulled low. The LED may flicker at turn on as the power supply settles.

10.3.15 Monitor Facilities

Eight monitor inputs are examined with the aid of a 1 of 8 analogue multiplexer U701. Any one of these eight inputs may be selected to be connected to the controller via rear plug pins 2, 3, 13 and 14.

This binary coded decimal (BCD) number may be selected and displayed on the Type 8080 Controller module front panel (refer to Section 2.6.5).

The analogue monitor outputs, their binary coded decimal number designation and associated pins on U701 are shown below.

BCD	Function	Pin No. on U701
0	Forward Power	13
1	VSWR	14
2	Lock Detect	15
3	Control Loop Voltage	12
4	0 V	1
5	Driver Output	5
6	Module Temp	2
7	+10 V Regulator Output	4

10.4 Transmitter Frequency Selection

10.4.1 General

It is possible to use any valid frequency within the specified operating band plan (403-423 MHz or 450-470 MHz) via selection of three Hexadecimal switches accessed through holes in the module shroud.

Note: The Transmitter module does not require further alignment once the correct Codes are selected within the specified operating band plan.

The Hexadecimal switches are immediately accessible upon removal of the wall mount cover. Refer to Section 4.6 for removal details.

Figure 10.1 shows the position of the switches

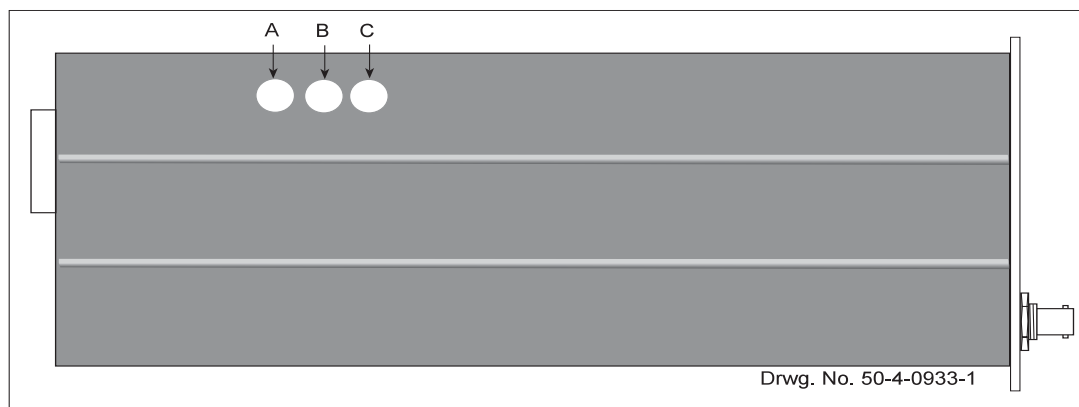


Figure 10.1: Frequency Selection Switches

Key

- A** Most Significant Bit (PCB reference SW304)
- B** PCB reference SW303
- C** Least Significant Bit (PCB reference SW302)

Note: The selected transmit frequencies are restricted to those with 6.25 kHz synthesiser increments (SL301 is not bridged on the module PCB)

10.4.2 Operating Frequency Charts

All valid frequencies and associated Hex Codes for each operating band plan are detailed within Appendix A, with default frequencies shown in **bold** text.

The relevant operating band plan is also provided underneath the wall mount cover. Refer to Section 4.6 for removal details.

Refer to the relevant chart as necessary to determine the correct Hex switch setting for the desired operating frequency.

10.4.3 Calculation Method

The Hex switch setting can be confirmed if necessary by the following process:

$$\text{Switch Setting} = \text{Hex} \left[\frac{\text{Required freq. (MHz)} - \text{start freq. (MHz)}}{\text{Synthesiser Step Size (MHz)}} \right]$$

Example:

Start frequency = 450.000 MHz (450 to 470 MHz band transmitter)
 Required frequency = 460.375 MHz
 Synthesiser Step Size = 6.25 kHz

Step 1

Calculate Decimal Number (base 10)

$$\frac{460.375 - 450.0}{0.00625} = 1660$$

This number represents the total number of 6.25 kHz steps above the start frequency necessary to achieve the required transmit frequency.

Step 2

Convert 1660 to a hexadecimal number to suit the frequency selection switches:

$$1660 \div 256 = 6.484375.$$

6 is a whole number so this is the correct setting for SW304 (MSB)

Step 3

Multiply the remainder (0.484375) by 256 = 124.

$$124 \div 16 = 7.75.$$

7 is the correct setting for SW303.

Step 4

Multiply the remainder (0.75) by 16 = 12.

12 is a whole number, use the table below to convert 12 to the correct Hexadecimal setting.

Hex Digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

C is the correct setting for SW302 (LSB)

Note: If the final figure is not a whole digit you have made an error in your calculations, or you have attempted to set a frequency which is not in the 5.0 or 6.25 kHz channel spacing band plan, and therefore not allowable.

Conversion complete 1660 = **67C** Hexadecimal (base 16)

This setting of the Hexadecimal Switches will produce the required frequency of 460.375 MHz for a transmitter in the 450-470MHz band with 6.25 kHz channel spacing

10.5 Transmitter Output Power Adjustment

10.5.1 General

The transmitter output power is adjusted using a multi-turn potentiometer in the transmitter module. Rotating the potentiometer in a clockwise direction increases the power and rotating in an anti-clockwise direction decreases the power. The potentiometer is adjusted through a hole on the right hand side of the module shroud (see Figure 10.2).

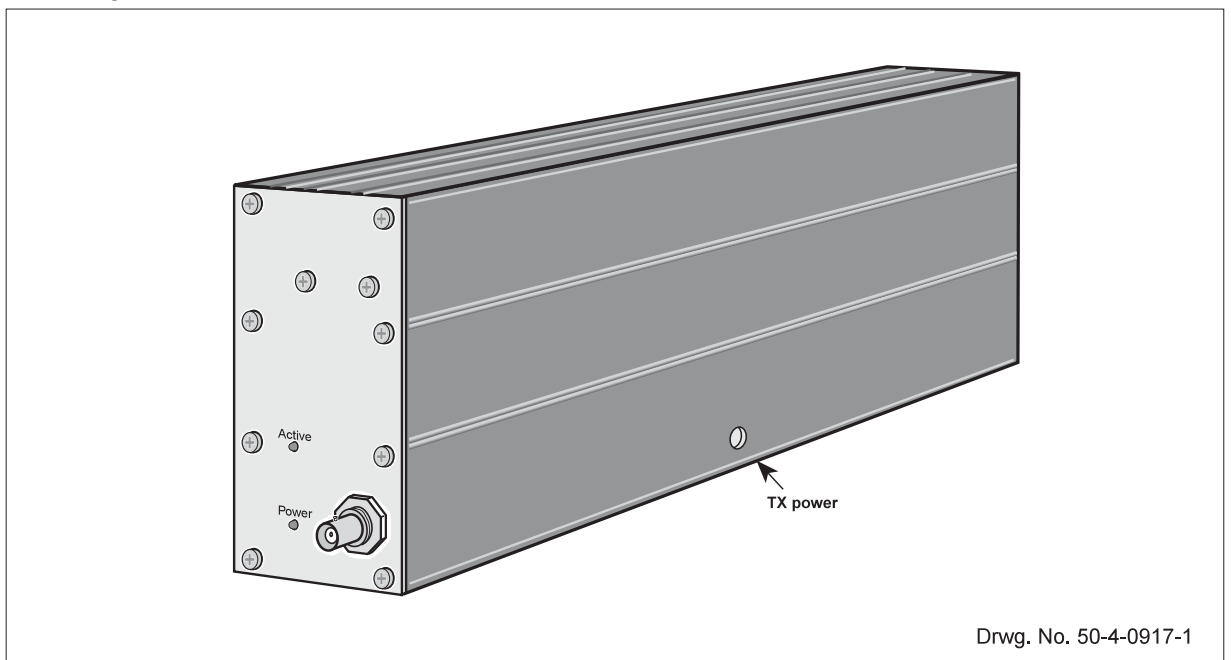
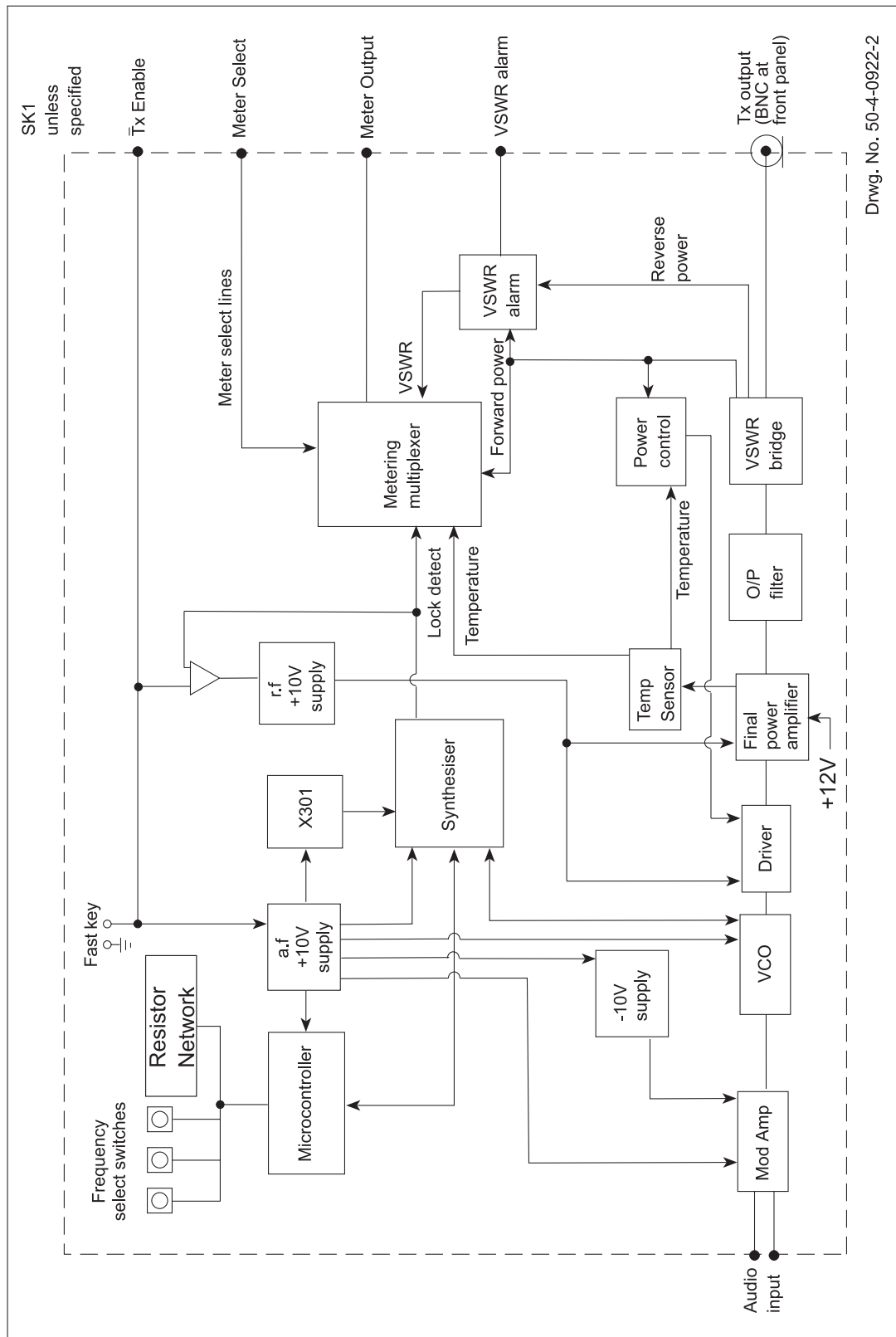


Figure 10.2: Transmitter Module Power Adjustment

10.5.2 Procedure

To adjust the RF output power of a wall mount terminal, proceed as follows:

1. Transmitter output power can be adjusted without removing the cover. Leave all cabling connected and remove the terminal from its mounting.
2. Activate the terminal.
3. Identify the hole on the underside of the terminal through which the potentiometer can be adjusted (refer to Section 1, figure 1.2, item 12),
4. Using a suitable screwdriver, adjust the potentiometer as required. Check the transmitter output power using an in-line RF Wattmeter in the antenna feeder.
5. Refer to Section 4.8.2 and check the RSSI at the remote terminal.
6. Refer to Section 4.8.3 and recalibrate the transmitter,
7. After re-calibrating the transmitter, replace the terminal on the wall. Ensure that all cables are connected and secure.
8. Perform a final check on the terminal to ensure correct operation.



Drwg. No. 50-4-0922-2

Figure 10.3: UHF Transmitter Block Diagram

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11

VHF Transmitter Type 2951

11.1 Introduction

The transmitter is synthesiser driven and direct frequency modulated.

Minimal audio processing occurs in the transmitter module. It is intended that this takes place in the Type 8080 Controller Module.



CAUTION

The VHF Transmitter module contains semi-conductor components that are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the modules should be performed at “electrostatically safe work stations” where the work bench surface; soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.



CAUTION

The RF devices used in the transmitter module (for example, the RF Power output module) may contain beryllium dioxide. These devices must not be broken, ground, hammered or tampered with in any way, and should be disposed of in a safe manner as specified in local environmental and safety legislation. If safe disposal is a problem, they should be sealed in an appropriate container and returned to Exicom for disposal. In this case, it is the senders' responsibility to ensure that all precautions are taken to ensure safe delivery to Exicom.

11.2 Specifications

Transmitter Type	Synthesised with direct frequency modulation
Synthesiser Step Size	5 kHz or 6.25 kHz (6.25 kHz is default)
Frequency Bands (MHz)	138-148, 148-162 , 159-174 (Bold RF band only to be supplied to Telstra)
Output Impedance	50 Ω
RF Output Power	1-15 W (adjustable)
RF Power Regulation Over specified bandwidth With Supply Voltage With Temperature	± 0.5 dB ± 1 dB for 10.6 V _{DC} to 15.5 V _{DC} ± 1 dB for -30 °C to +55 °C
Duty Cycle	100% from -30 °C to +55 °C up to an altitude of 3000 m
Frequency Stability	± 1.0 ppm from -30 °C to +55 °C and with a supply voltage of 10.6 V _{DC} to 15.5 V _{DC}
Spurious Outputs	<0.25 μ W (-36 dBm) from 100 kHz to 4 GHz
Adjacent Channel Power	<-25 dBm for 25 kHz Channel Spacing
VSWR Protection	Withstands VSWR of 20:1 at any phase angle
Thermal Protection	Integral. RF output power automatically reduced when module heatsink temperature reaches 95 °C ± 5 °C
Modulation Distortion Deviation	Direct frequency modulation <1.0% at 3 kHz deviation weighted Adjustable 1.5 kHz to 5 kHz
Modulation Input Impedance	Hi "Z" (36 k Ω) differential input
Modulation Input	775 mV _{rms}
Audio Frequency Response	± 0.3 dB from 300 Hz to 8.2 kHz with DC response option
Hum and Noise	>39 dB unweighted wide band
Transmitter Switching Bandwidth	10 MHz for 68 to 88 MHz bands 14MHz for 138 to 174 MHz bands
Residual AM	<0.5%
Carrier Leakage	<-65 dBm
Environmental	Operates within -30 °C to +55 °C, up to 95% relative humidity, non-condensing
Operational Voltage Range	10.6 V _{DC} to 15.5 V _{DC}

Maximum DC Supply Current at 13.8 VDC input (Typical measurements only)	Standby, non-fast key configuration	15 mA
	Standby, Fast Key configuration	110 mA
	Tx keyed, 1 Watt output from Duplexer (approx. 1.3 W from Tx)	1.0 A
	Tx keyed, 10 Watts output from Duplexer (approx. 13 W from Tx)	2.6 A
Maximum Tx key up delay¹ (Typical measurements only)	Non-fast key configuration	100 ms
	Fast Key configuration	3.0 ms

11.3 Circuit Description

The following section provides a detailed description of the operation of the circuit.

11.3.1 Voltage Controlled Oscillator (VCO) and Modulator



The transmitter VCO is **NOT** field serviceable. Repairing and testing of the VCO is best done in the factory.

The VCO contains the resonator, oscillator and frequency control varicap, in a factory-enclosed assembly. The VCO is tuneable via a trimmer that is accessible through the top of the shield.

11.3.2 Frequency Synthesiser Circuitry

When the transmitter is powered-up, the three parallel to serial converters, U303A, U304A and U305A receive inputs from the resistor programming network (comprising R770-R777 inclusive) and the Hexadecimal frequency select switches, SW302, SW303 and SW304.

Resistor Programming Network

The resistor programming network sets the relevant operating frequency band of the transmitter (the three Hexadecimal switches select the actual frequency channel that the transmitter will operate at)

The table below shows the selection of the relevant operating frequency band via the resistor programming network.

Note: The relevant operating frequency band will have been selected during manufacture. It is not likely that this would need to be selected after delivery.

¹ Delay from “key up” signal input to 50% power present at the RF output connector

RF Band (MHz)	R777	R776	R775	R774	R773	R772	R771	R770
148-162	ON	ON	OFF	OFF	OFF	ON	OFF	ON

These parallel inputs are fed or “clocked” serially to pin 12 of the microcontroller U302. The twenty-four clock pulses required by U303A, U304A and U305A are generated by U302.

The synthesiser step size is set to 6.25 kHz (SL301 is not bridged). U302 uses this input and the data it receives on pin 12 to derive the frequency data sent to the Phase Locked Loop IC U307. U307 compares the output from the VCO on pin 8 with the TCXO signal on pin 1 to derive the VCO control signal, which it outputs on pin 5.

The signal is then filtered by the loop filter operational amplifier U308A. The output signal from the filter, VCOTUNE, controls the VCO and can be monitored on TP301.

U307 also sends status information from pin 7 to U302, which indicates whether U307 has successfully “locked” to the required frequency. When U307 has achieved frequency lock, U302 takes pin 17 low. The output from pin 17 is the LOCK_DET signal; this can be monitored on TP403.

11.3.3 Reference Oscillator

This comprises X301, a 9.60 MHz TCXO. A trimmer on X301 can be adjusted so that it provides exactly 9.600000 MHz.

11.3.4 VCO Supply

U401 is a switching regulator that inverts its supply voltage when used with C405 and C407. This voltage is applied to bias the VCO and the audio stage.

11.3.5 Audio Line Input and Level Control

Balanced audio input of 775 mV_{rms} (for nominal deviation) is applied to pins 8 and 20 (SK101) which is protected against Electromagnetic Interference (EMI) by the inductor capacitor filters (L106, L107 and C125, C126, C128 and C129). This signal is applied to U101D that provides common mode rejection against external hum and noise at the two-wire line input. This voltage may be monitored at TP102 and TP104.

The test point TP107 may be used for fault tracing, with an oscilloscope. A 775 mV_{rms} sinewave at this point should cause 3 kHz of FM deviation.

Audio limiting and filtering is external to the transmitter.

11.3.6 RF Driver

Q501 a dual gate FET and Q502 form a broad band RF amplifier with 36 dB gain and 400 mW output capability. Gate 2 of Q501 regulates the transmitter output power by adjusting the stage gain.

The input to Q501 is via C501, L508 and L501. These components form an impedance matching network; similar matching is used between Q501 and Q502. Output matching to 50 Ω is performed by a modified pi network C523, C527, C528 and L509. All of these networks are relatively low Q giving 1-dB bandwidths of at least 40 MHz at VHF frequencies.

11.3.7 RF Power Amplifier

The power amplifier consists of a broad band hybrid power module. RF drive is fed to the power amplifier via a coaxial cable. U601 is supplied with 10 V on pin 2 and 12 V on pins 3 and 4. Thermal protection is given by U653 (refer to Section 11.3.11).

11.3.8 Dual Directional Coupler

Output of the power amplifier module is fed via a low pass elliptical filter to the dual directional coupler. This provides sample voltages for forward and reflected power, which are used to give an indication of the VSWR of the transmitter load. The forward power voltage is also used in the power control loop to keep the transmitter output power constant.

11.3.9 High Pass Filtering

The RF output from the power amplifier module is also fed to an absorptive high pass elliptical filter. This keeps the harmonic energy to a minimum.

11.3.10 RF Power Output Control

Voltage from the forward power port of the dual directional coupler feeds the constant output power loop. The loop consists of U702B and Q501 with RV701 enabling the transmitter output power to be adjusted from 1 W to 15 W.

As the voltage at the forward power port of the dual directional coupler increases, the voltage on Gate 2 of Q501 is reduced by the control loop and so the transmitter output power is reduced (and vice versa). This keeps the output power constant for supply voltage variations.

By grounding the base of Q702 through D710 at pin 5 of the rear panel socket (thus interrupting the constant power loop), the power output can be reduced externally, e.g. from the receiver module when the receiver is overloaded.

11.3.11 Thermal Protection of the RF Power Amplifier Module

U653 is mounted on the flange of U601 and increases its output voltage at a rate of 10 mV/°C. When its output reaches 950 mV (indicating a heatsink temperature of 95 °C), it turns Q701 on, which reduces Q702 emitter voltage. This controls the operation of the output power control loop reducing the power output of the transmitter until thermal equilibrium is reached.

11.3.12 VSWR Alarm

The forward and reflected power voltages from the dual directional coupler are fed to a differential amplifier U702/A via two logarithmic elements contained in D703. The output of U702/A is thus a function of VSWR and is fed to the monitor. Q704 switches the VSWR ALARM and its threshold is set by RV702.

11.3.13 Audio and Synthesiser Power Supply

This 10 V supply is based on U152, which uses a 4 V reference, set up by R151 and R152. This is compared to a feedback voltage and varies the conduction of Q152 via Q151 to maintain 10 V. U151 is an unswitched 8 V regulator that supplies U152B and the 4 V reference. U152A is switched on at Tx power up and may be permanently powered up by the "fast key" shunt PL151. This provides for faster Tx activation as the synthesiser is maintained powered on and in a locked state.

11.3.14 RF Power Supply

This 10 V supply has the same operation as the audio and synthesiser power supply. It is only switched on when the synthesiser is locked and the transmitter enabled, being switched via R655 by a low on the RF_EN line. Q652 is able to supply the higher current demands of pin 2 of U601 and the driver stage.

D603, a red LED on the module front panel, indicates when the RF power supply is enabled. This only occurs when synthesiser lock is established and the Tx_key line is pulled low. The LED may flicker at turn on as the power supply settles.

11.3.15 Monitor Facilities

Eight monitor inputs are examined with the aid of a 1 of 8 analogue multiplexer U701. Any one of these eight inputs may be selected to be connected to the controller via rear plug pins 2, 3, 13 and 14.

This binary coded decimal (BCD) number may be selected and displayed on the Type 8080 Controller module front panel (refer to Section 2.6.5).

The analogue monitor outputs, their binary coded decimal number designation and associated pins on U701 are shown below.

Decimal No.	Function	Pin No. on U701
0	Forward Power	13
1	VSWR	14
2	Lock Detect	15
3	Control Loop Voltage	12
4	0 V	1
5	Driver Output	5
6	Module Temp	2
7	+10 V Regulator Output	4

11.4 Transmitter Frequency Selection

11.4.1 General

It is possible to use any valid frequency within the specified operating band plan (148-162 MHz) via selection of three Hexadecimal switches accessed through holes in the module shroud.

Note: The Transmitter module does not require further alignment once the correct Codes are selected within the specified operating band plan.

The Hexadecimal switches are immediately accessible upon removal of the wall mount cover. Refer to Section 4.6 for removal details.

Figure 11.1 shows the position of the switches

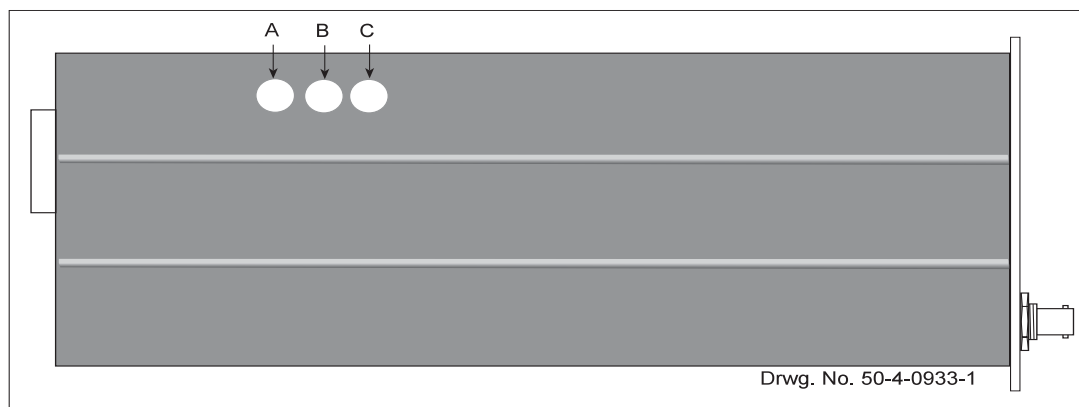


Figure 11.1: Frequency Selection Switches

Key

- A** Most Significant Bit (PCB reference SW4)
- B** PCB reference SW3
- C** Least Significant Bit (PCB reference SW2)

Note: The selected transmit frequencies are restricted to those with 6.25 kHz synthesiser increments (SL301 is not bridged on the module PCB)

11.4.2 Operating Frequency Charts

All valid frequencies and associated Hex Codes for each operating band plan are detailed within Appendix A, with default frequencies shown in **bold** text.

The relevant operating band plan is also provided underneath the wall mount cover. Refer to Section 4.6 for removal details.

Refer to the relevant chart as necessary to determine the correct Hex switch setting for the desired operating frequency.

11.4.3 Calculation Method

The Hex switch setting can be confirmed if necessary by the following process:

$$\text{Switch Setting} = \text{Hex} \left[\frac{\text{Required freq. (MHz)} - \text{start freq. (MHz)}}{\text{Synthesiser Step Size (MHz)}} \right]$$

Example:

Start frequency = 148.000 MHz (148 to 162 MHz band Transmitter)
 Required frequency = 150.725 MHz
 Synthesiser Step Size = 6.25 kHz

Step 1

Calculate Decimal Number (base 10)

$$\frac{150.725 - 148.0}{0.00625} = 436$$

This number represents the total number of 6.25 kHz steps above the start frequency necessary to achieve the required transmit frequency.

Step 2

Convert 436 to a hexadecimal number to suit the frequency selection switches:

$$436 \div 256 = 1.703125.$$

1 is a whole number so this is the correct setting for SW4 (MSB)

Step 3

Multiply the remainder (0.703125) by 256 = 180.

$$180 \div 16 = 11.25.$$

11 is a whole number, use the table below to convert 11 to the correct Hexadecimal setting.

Hex Digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

B is the correct setting for SW3

Step 4

Multiply the remainder (0.25) by 16 = 4.

4 is the correct setting for SW2 (LSB)

Note: If the final figure is not a whole digit you have made an error in your calculations, or you have attempted to set a frequency which is not in the 5.0 or 6.25 kHz channel spacing band plan, and therefore not allowable.

Conversion complete 436 = **1B4** Hexadecimal (base 16)

This setting of the Hexadecimal Switches will produce the required frequency of 150.725 MHz for a Transmitter in the 148 - 162MHz band with 6.25 kHz channel spacing

11.5 Transmitter Output Power Adjustment

11.5.1 General

The transmitter output power is adjusted using a multi-turn potentiometer in the transmitter module. Rotating the potentiometer in a clockwise direction increases the power and rotating in an anti-clockwise direction decreases the power. The potentiometer is adjusted through a hole on the right hand side of the module shroud (see Figure 11.2).

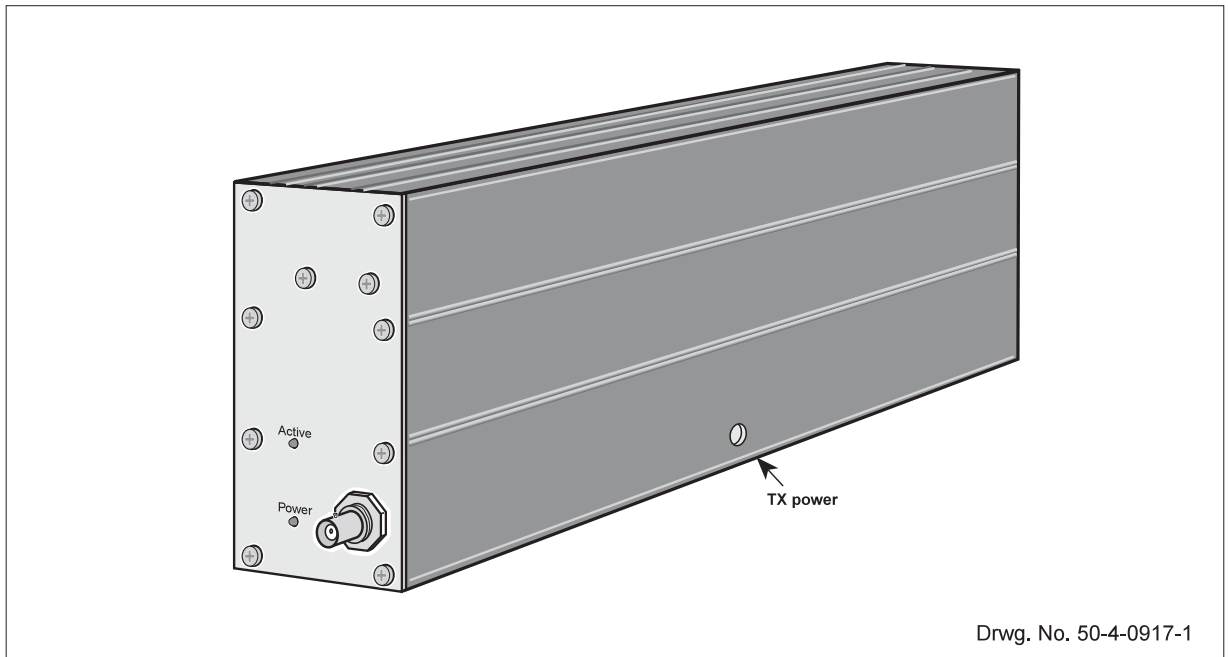


Figure 11.2: Transmitter Module Power Adjustment

11.5.2 Procedure

To adjust the RF output power of a wall mount terminal, proceed as follows:

1. Transmitter output power can be adjusted without removing the cover. Leave all cabling connected and remove the terminal from its mounting.
2. Activate the terminal.
3. Identify the hole on the underside of the terminal through which the potentiometer can be adjusted (refer to Section 1, figure 1.2, item 12),
4. Using a suitable screwdriver, adjust the potentiometer as required. Check the transmitter output power using an in-line RF Wattmeter in the antenna feeder.
5. Refer to Section 4.8.2 and check the RSSI at the remote terminal.
6. Refer to Section 4.8.3 and recalibrate the transmitter,
7. After re-calibrating the transmitter, replace the terminal on the wall. Ensure that all cables are connected and secure.
8. Perform a final check on the terminal to ensure correct operation.

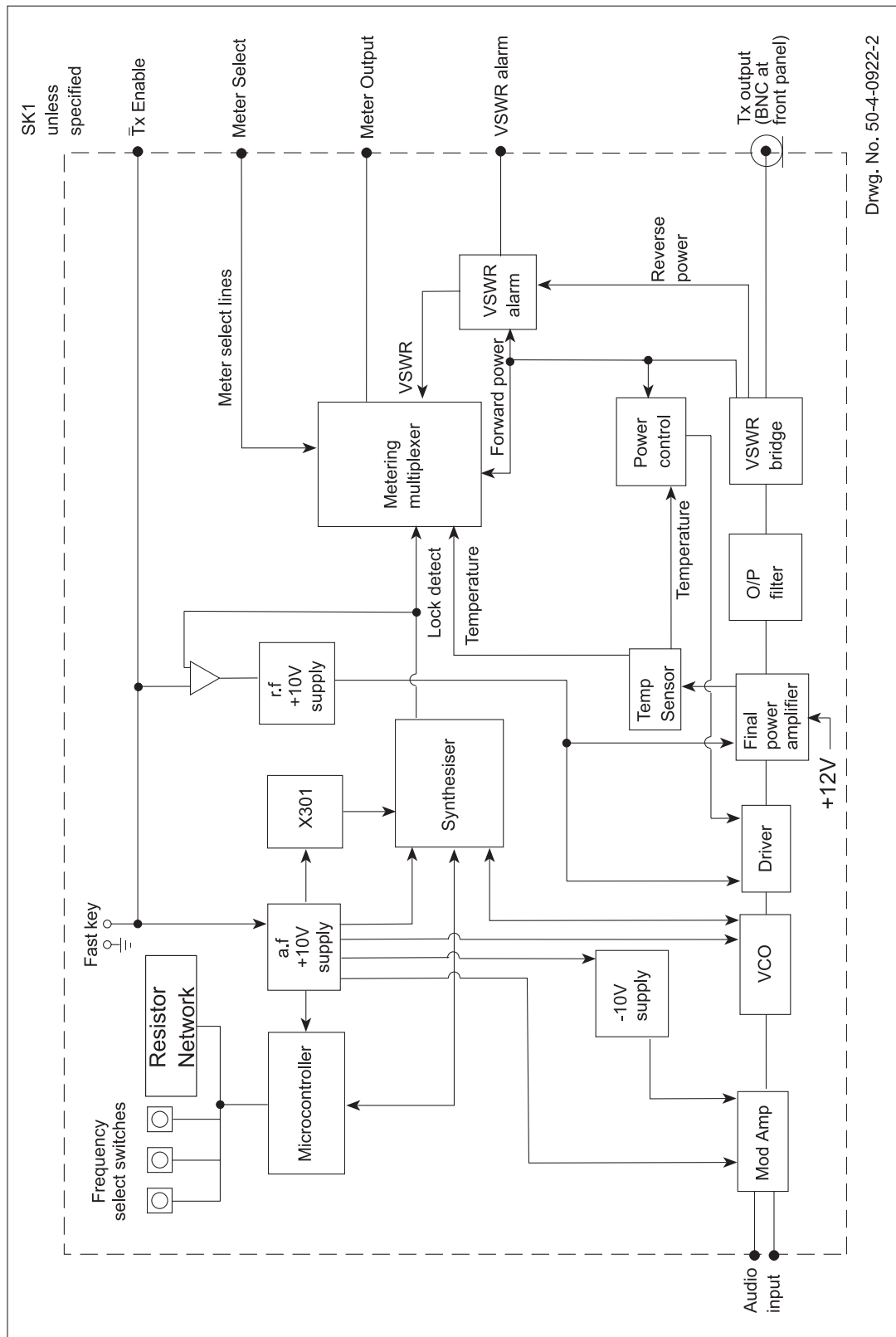


Figure 11.3: VHF Transmitter Block Diagram

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12

Motherboard Type 8081

12.1 Introduction

The motherboard provides the interconnection between the individual Hawk modules as well as power and line connections to/from the external sources. It also provides access to the Link Fail Alarm relay and the RS232 port in the Controller module (via SK105 and SK106 respectively. Refer to Section 12.4)

12.2 Module Interconnections

Each motherboard has four plugs on the module facing side, assigned to the following Hawk modules:

- > PL101 - Receiver module,
- > PL201 - Transmitter module,
- > PL301 - Controller module,
- > PL401 - Line interface module.

When the modules are correctly inserted into position, the connector on the rear of each module fits into the associated plug on the motherboard.

The Duplexer module is not connected to the other modules via the motherboard.

12.3 Power and Line Connections

12.3.1 Power Connector

The external 13.8 V DC power supply is connected to the Hawk terminal via PL105. PL105 has two associated components, FS101 and D101. FS101 is a 5 A fuse providing overcurrent protection for the terminal. D101 is a Zener diode used to provide the terminal with reverse polarity and over-voltage protection

The motherboard is located underneath the terminal cover. PL105 is accessible through a hole in the rear of the terminal chassis while FS101 and D101 are located on the module facing side of the motherboard and can only be accessed after the cover has been removed.

Refer to Section 3.6.4 for further details regarding Power connections.

12.3.2 Line Interfaces

The external line interfaces to the Hawk terminal are made via four RJ-11 connectors. There are two connectors for each audio channel; one for a 2-wire connection and one for a 4-wire plus E and M connection. The connector assignments are as follows:

- > SK101 - Channel B 2-wire socket,
- > SK201 - Channel B 4-wire plus E and M socket,
- > SK103 - Channel A 2-wire socket,
- > SK104 - Channel A 4-wire plus E and M socket.

Refer to Section 3.6.3 for further details regarding Line connections.

12.4 Link Fail Alarm and RS232 Access

12.4.1 Link Fail Alarm (SK105)

Relay RL101 is located on the motherboard PCB and is controlled via software within the type 8080 Controller module

The software allows the integrity of the radio link to be checked; if a link cannot be established (link ID not correct or unobtainable) or RSSI is out of specification, RL101 will activate, providing an external output via RJ45 socket SK105.

Refer to Section 3.6.7 for further details regarding the operation of RL101 and connection to SK105.

12.4.2 RS232 Access (SK106)

The type 8080 Controller module has an RS232 port that allows remote access of various diagnostic and configuration parameters via the use of a suitable Windows-based program (such as HyperTerminal etc)

Refer to Section 3.6.8 for further details regarding the RS232 connection.

13

DC-DC Power Supply Type 2461

13.1 Introduction

The Type 2461 DC-DC Power Supply enables the Hawk to be powered from a 22 to 60V DC supply input, with a nominal 13.6 V DC output



The semi-conductor components in the DC-DC Power Supply module are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the module should be carried out at “electrostatically safe work stations” where the work bench surface, soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.

13.2 Circuit Description

The basic configuration of this power supply is a switched mode converter with input and output DC isolated. Regulation is achieved by optically coupled feedback controlling pulse width.

The nominal 24 or 48 volt DC supply enters the module via SK2 and is filtered via inductors L1, L2, L3 and associated capacitors C2, C3, C4, C8 and C12.

The filtered DC voltage is protected by 20mm fuse FS1 (20mm or 30mm fuses may be fitted by modifying the position of the input terminal of the fuse holder)

Polarity protection is provided by D2. Overvoltage input shutdown above 72 volts is provided by D1, D5 and TR1. Pulse width modulator IC2 drives FETs TR6 and TR7 with a 100kHz square wave via complementary symmetry driver TR3 and TR4. During the “off” period, D11 conducts due to the collapsing magnetic field in T1 returning this energy to the supply capacitors.

During the “on” period, current from the secondary of T1 feeds into the switchmode inductor L7 via one of the D14 diodes. In the “off” period, the other D14 flywheel diode conducts to transfer the L7 stored energy to the output capacitors.

Output voltage is sensed by D16 and optically coupled via IC1 to control the duty cycle of IC2.

Power FET current is sensed at source resistors R19, R31 and R32. Average current is sensed at IC2 pin 4 and peak current at pin 10 to provide protective shutdown of IC2 output. A soft start power supply turn on characteristic is provided by C13 to limit inrush currents.

Output overvoltage protection for inductive load transients is provided by R30. Extensive onboard RFI suppression and input/output filtering ensure a low level of conducted and radiated emissions.

The nominal 13.6 V DC supply is output via Sk1.

13.3 Servicing

There are no user adjustments provided. Link J1 is provided in the drain connection of power FETs TR6 and TR7. During servicing of faulty units, disconnecting this link will enable the supply to be tested up to the FET gates where a 10V peak to peak 100kHz wave form with less than 50% duty cycle should be observed on the oscilloscope.

A 100kHz sawtooth waveform of less than 50% duty cycle will be present on the FET drains. Peak to peak amplitude is half supply voltage, i.e. 12V p-p for a 24V power supply, or 24Vp-p for a 48V power supply.

Operation of the overvoltage shutdown can be checked at this time.

Note: Do not close J1 until these conditions have been met. Operate the unit under test from a 0-65V supply limited to 3A. It should start up at 19V input and shut down at 72V.

Full load input current is 2.25A at 23V input to less than 1.5A at 56V.

With a short-circuited output, input current is limited to less than 1.5A.

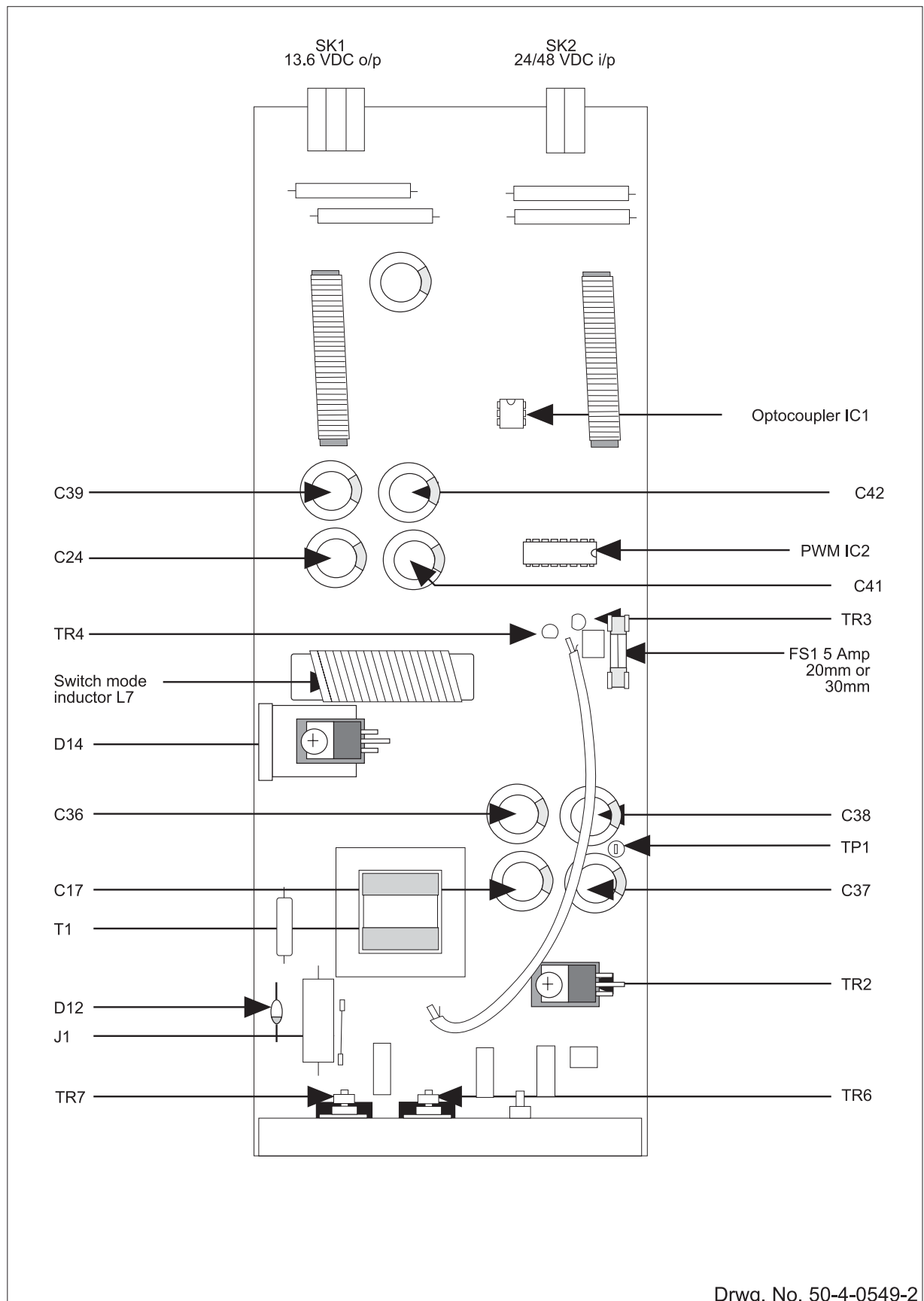


Figure 13.1 DC-DC Converter Type 2461

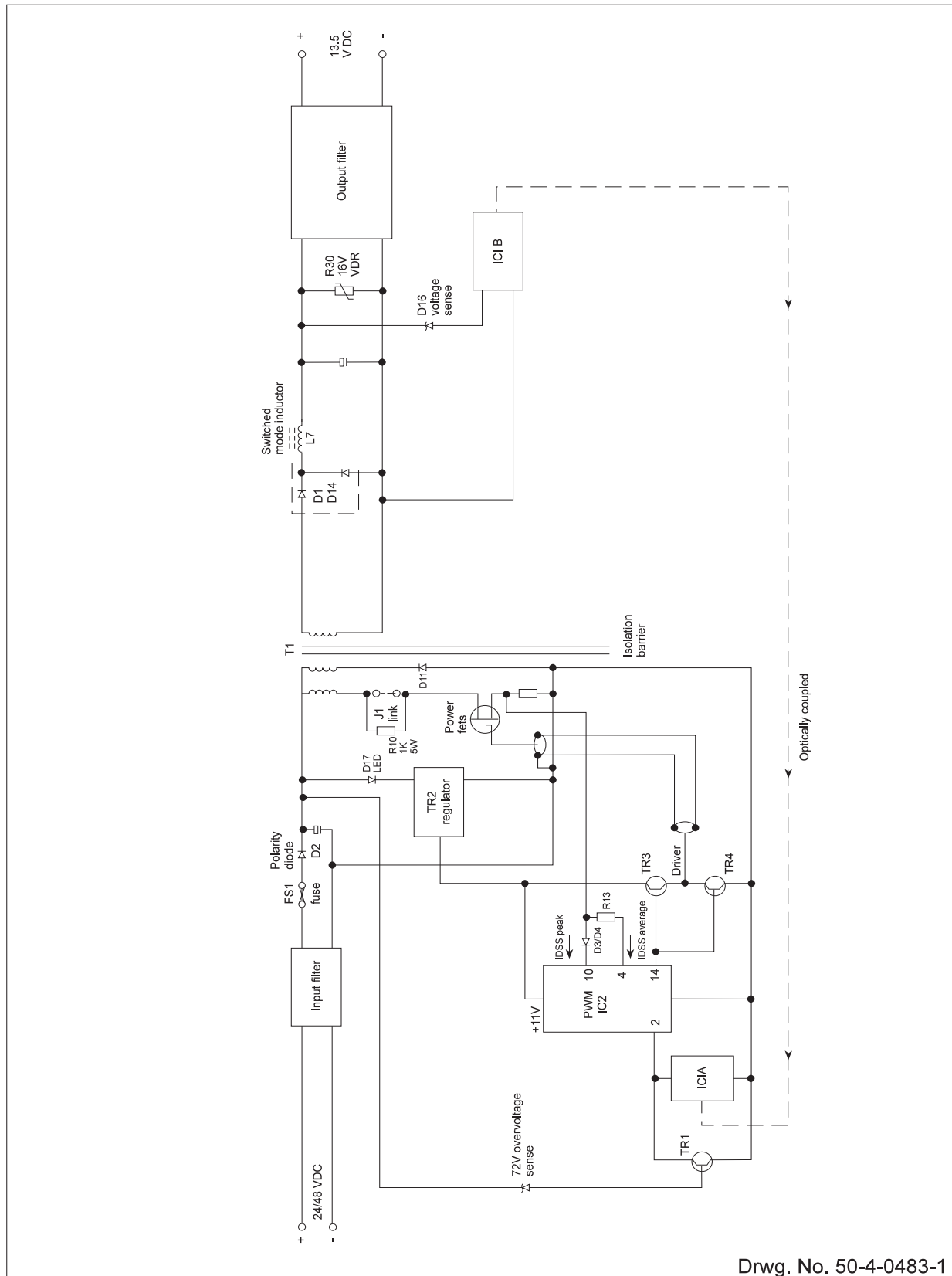


Figure 13.2 DC-DC Converter Power Supply Type 2461 Block Diagram

14

Payphone Type 8075

14.1 Introduction

The Type 8075 payphone module is designed to interface with a customer's payphone; it is capable of both detecting and generating meter pulse and line reversal signals. This module may be used on the Customer or Exchange terminal.

The 8075 module can be used as a replacement for the earlier 2835 Meter Pulse and the 2854 Line Reversal interfaces. There are two modes of operation for meter pulse generation: 12 and 16 kHz. The FX 641 tone detect chip is used to detect the 12 and 16 kHz meter pulses and requires no tuning.



CAUTION

The semi-conductor components in the Payphone module are sensitive to electrostatic damage.

Electrostatic sensitive devices should only be stored and transported inside electrically conductive static shielding bags. Repair work on the module should be carried out at "electrostatically safe work stations" where the work bench surface, soldering iron and the operator are all earthed to prevent the build up of harmful electrostatic charges.

14.2 Circuit Description

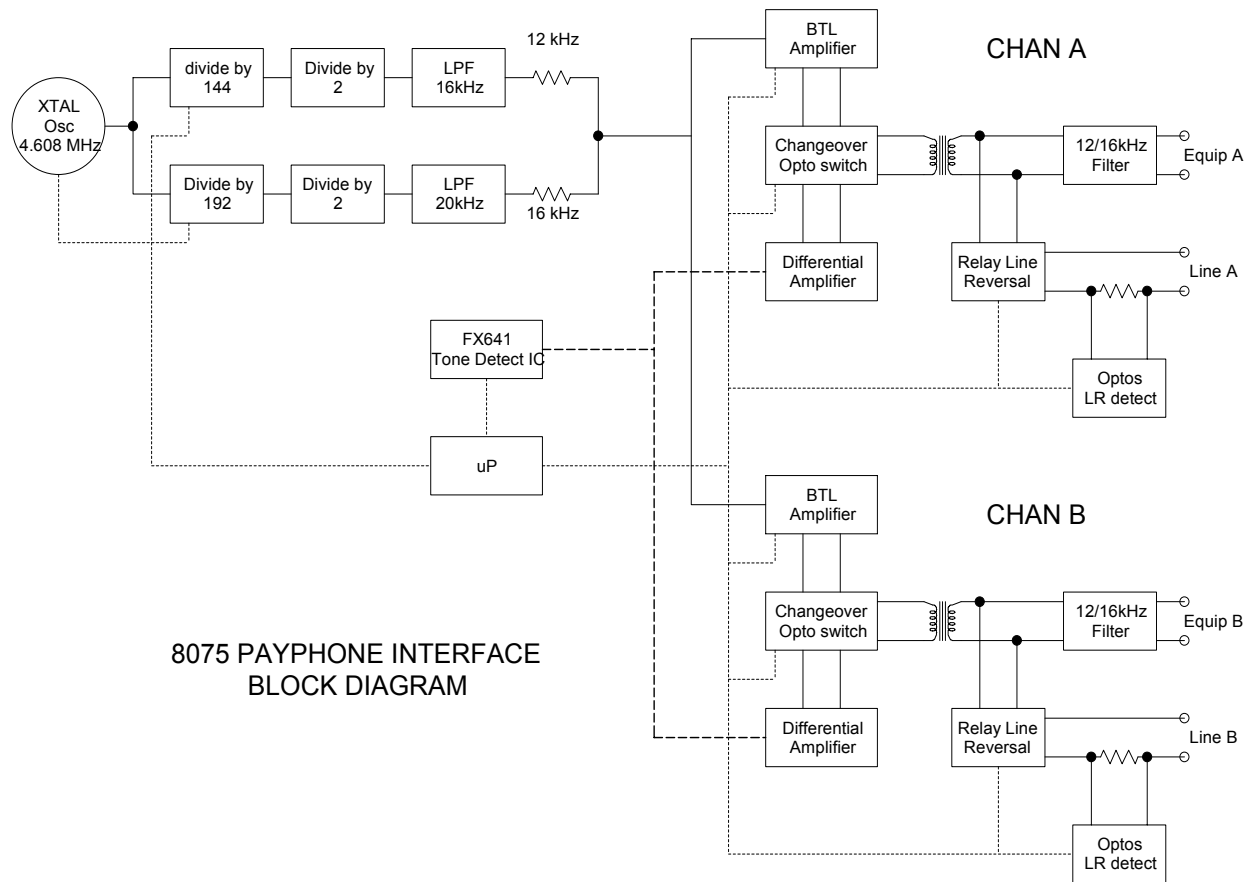


Figure 14.1: 8075 Payphone Interface Block Diagram

14.2.1 Tone detection/generation circuit

The microprocessor has overall control over the devices within the module

The Opto-coupler switches are used to switch between meter generation and detection as shown in the diagram above.

Tone Detection

The FX641 (U203) IC detects 12 or 16kHz meter pulses automatically. Sensitivity may be adjusted in the factory to meet customer requirements. The default setting is 80mV

Tone Generation

This circuit generates a tone at either 12 or 16 kHz for billing. The tone is normally set in the factory to the customer requirement and is not recommended for field-change.

The output level may be adjusted to suit customer requirements to a maximum of 2.9 V RMS. The default level is 2.1V RMS +/- 50 mV

Line filters are used to provide at least 40 dB of attenuation to meter pulse tones reaching the equipment interface circuits.

14.2.2 Line reversal circuit

Detection

The detection circuit is provided via two 4N35 opto-couplers (U113, U114) across a 100 ohm (R120) resistor. This circuit is sensitive down to 12.5 mA

Generation

Relay RL102 (Ch A) and Relay RL101 (Ch B) is used to provide a line reversal.

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Appendix A

Operating Frequency Charts

A.1 General

This Appendix contains three charts detailing all of the applicable RF frequencies and associated Hex Codes for each operating band plan.

A.1.1 Duplexer Module Default Frequencies

The Duplexer module within each Hawk Terminal will always be set to the centre-band frequencies shown in the table below:

Operating Band Plan	Tx Low (Exchange)	Tx High (Customer)
150 MHz	150.7250 MHz	155.3250 MHz
400 MHz	404.5000 MHz	413.9500 MHz
450 MHz	451.0000 MHz	460.5000 MHz

A.1.2 Transmitter and Receiver module frequencies

It is possible to use other frequencies within the specified operating band plan by selecting the appropriate Hex Code in each Transmitter and Receiver module.

Note: The RF modules (Transmitter, Receiver and Duplexer) do not require further alignment once the correct Codes are selected.

Frequency Pairs

It is important that the Tx Low and Tx High operating frequencies are selected in pairs as shown on the charts.

A.1.3 Frequency settings prior to despatch

Each Terminal will be supplied with the operating frequencies either:

- > Set to the desired frequencies specified upon order placement, or,
- > Set to the appropriate default frequencies shown above

Module and Terminal Labelling¹

Each Terminal has a label attached underneath the chassis detailing the applicable operating frequencies. Each Transmitter and Receiver module will also be labelled with the applicable operating frequency.

¹ Note that if Terminals are set to the DEFAULT frequencies prior to despatch, the chassis and module labels will be left **blank** to allow the actual frequencies to be written after installation.

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A.2 DCRS 150 MHz Band Plan (Defaults shown in bold)

Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting	Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting
1	150.0625	14A	154.6625	42A	54	150.7250	1B4	155.3250	494
2	150.0750	14C	154.6750	42C	55	150.7375	1B6	155.3375	496
3	150.0875	14E	154.6875	42E	56	150.7500	1B8	155.3500	498
4	150.1000	150	154.7000	430	57	150.7625	1BA	155.3625	49A
5	150.1125	152	154.7125	432	58	150.7750	1BC	155.3750	49C
6	150.1250	154	154.7250	434	59	150.7875	1BE	155.3875	49E
7	150.1375	156	154.7375	436	60	150.8000	1C0	155.4000	4A0
8	150.1500	158	154.7500	438	61	150.8125	1C2	155.4125	4A2
9	150.1625	15A	154.7625	43A	62	150.8250	1C4	155.4250	4A4
10	150.1750	15C	154.7750	43C	63	150.8375	1C6	155.4375	4A6
11	150.1875	15E	154.7875	43E	64	150.8500	1C8	155.4500	4A8
12	150.2000	160	154.8000	440	65	150.8625	1CA	155.4625	4AA
13	150.2125	162	154.8125	442	66	150.8750	1CC	155.4750	4AC
14	150.2250	164	154.8250	444	67	150.8875	1CE	155.4875	4AE
15	150.2375	166	154.8375	446	68	150.9000	1D0	155.5000	4B0
16	150.2500	168	154.8500	448	69	150.9125	1D2	155.5125	4B2
17	150.2625	16A	154.8625	44A	70	150.9250	1D4	155.5250	4B4
18	150.2750	16C	154.8750	44C	71	150.9375	1D6	155.5375	4B6
19	150.2875	16E	154.8875	44E	72	150.9500	1D8	155.5500	4B8
20	150.3000	170	154.9000	450	73	150.9625	1DA	155.5625	4BA
21	150.3125	172	154.9125	452	74	150.9750	1DC	155.5750	4BC
22	150.3250	174	154.9250	454	75	150.9875	1DE	155.5875	4BE
23	150.3375	176	154.9375	456	76	151.0000	1E0	155.6000	4C0
24	150.3500	178	154.9500	458	77	151.0125	1E2	155.6125	4C2
25	150.3625	17A	154.9625	45A	78	151.0250	1E4	155.6250	4C4
26	150.3750	17C	154.9750	45C	79	151.0375	1E6	155.6375	4C6
27	150.3875	17E	154.9875	45E	80	151.0500	1E8	155.6500	4C8
28	150.4000	180	155.0000	460	81	151.0625	1EA	155.6625	4CA
29	150.4125	182	155.0125	462	82	151.0750	1EC	155.6750	4CC
30	150.4250	184	155.0250	464	83	151.0875	1EE	155.6875	4CE
31	150.4375	186	155.0375	466	84	151.1000	1F0	155.7000	4D0
32	150.4500	188	155.0500	468	85	151.1125	1F2	155.7125	4D2
33	150.4625	18A	155.0625	46A	86	151.1250	1F4	155.7250	4D4
34	150.4750	18C	155.0750	46C	87	151.1375	1F6	155.7375	4D6
35	150.4875	18E	155.0875	46E	88	151.1500	1F8	155.7500	4D8
36	150.5000	190	155.1000	470	89	151.1625	1FA	155.7625	4DA
37	150.5125	192	155.1125	472	90	151.1750	1FC	155.7750	4DC
38	150.5250	194	155.1250	474	91	151.1875	1FE	155.7875	4DE
39	150.5375	196	155.1375	476	92	151.2000	200	155.8000	4E0
40	150.5500	198	155.1500	478	93	151.2125	202	155.8125	4E2
41	150.5625	19A	155.1625	47A	94	151.2250	204	155.8250	4E4
42	150.5750	19C	155.1750	47C	95	151.2375	206	155.8375	4E6
43	150.5875	19E	155.1875	47E	96	151.2500	208	155.8500	4E8
44	150.6000	1A0	155.2000	480	97	151.2625	20A	155.8625	4EA
45	150.6125	1A2	155.2125	482	98	151.2750	20C	155.8750	4EC
46	150.6250	1A4	155.2250	484	99	151.2875	20E	155.8875	4EE
47	150.6375	1A6	155.2375	486	100	151.3000	210	155.9000	4F0
48	150.6500	1A8	155.2500	488	101	151.3125	212	155.9125	4F2
49	150.6625	1AA	155.2625	48A	102	151.3250	214	155.9250	4F4
50	150.6750	1AC	155.2750	48C	103	151.3375	216	155.9375	4F6
51	150.6875	1AE	155.2875	48E	104	151.3500	218	155.9500	4F8
52	150.7000	1B0	155.3000	490	105	151.3625	21A	155.9625	4FA
53	150.7125	1B2	155.3125	492	106	151.3750	21C	155.9750	4FC
					107	151.3875	21E	155.9875	4FE

A.3 DCRS 400 MHz Band Plan (Defaults shown in **bold**)

Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting		Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting
1	404.0500	0A8	413.5000	690		40	404.5375	0F6	413.9875	6DE
2	404.0625	0AA	413.5125	692		41	404.5500	0F8	414.0000	6E0
3	404.0750	0AC	413.5250	694		42	404.5625	0FA	414.0125	6E2
4	404.0875	0AE	413.5375	696		43	404.5750	0FC	414.0250	6E4
5	404.1000	0B0	413.5500	698		44	404.5875	0FE	414.0375	6E6
6	404.1125	0B2	413.5625	69A		45	404.6000	100	414.0500	6E8
7	404.1250	0B4	413.5750	69C		46	404.6125	102	414.0625	6EA
8	404.1375	0B6	413.5875	69E		47	404.6250	104	414.0750	6EC
9	404.1500	0B8	413.6000	6A0		48	404.6375	106	414.0875	6EE
10	404.1625	0BA	413.6125	6A2		49	404.6500	108	414.1000	6F0
11	404.1750	0BC	413.6250	6A4		50	404.6625	10A	414.1125	6F2
12	404.1875	0BE	413.6375	6A6		51	404.6750	10C	414.1250	6F4
13	404.2000	0C0	413.6500	6A8		52	404.6875	10E	414.1375	6F6
14	404.2125	0C2	413.6625	6AA		53	404.7000	110	414.1500	6F8
15	404.2250	0C4	413.6750	6AC		54	404.7125	112	414.1625	6FA
16	404.2375	0C6	413.6875	6AE		55	404.7250	114	414.1750	6FC
17	404.2500	0C8	413.7000	6B0		56	404.7375	116	414.1875	6FE
18	404.2625	0CA	413.7125	6B2		57	404.7500	118	414.2000	700
19	404.2750	0CC	413.7250	6B4		58	404.7625	11A	414.2125	702
20	404.2875	0CE	413.7375	6B6		59	404.7750	11C	414.2250	704
21	404.3000	0D0	413.7500	6B8		60	404.7875	11E	414.2375	706
22	404.3125	0D2	413.7625	6BA		61	404.8000	120	414.2500	708
23	404.3250	0D4	413.7750	6BC		62	404.8125	122	414.2625	70A
24	404.3375	0D6	413.7875	6BE		63	404.8250	124	414.2750	70C
25	404.3500	0D8	413.8000	6C0		64	404.8375	126	414.2875	70E
26	404.3625	0DA	413.8125	6C2		65	404.8500	128	414.3000	710
27	404.3750	0DC	413.8250	6C4		66	404.8625	12A	414.3125	712
28	404.3875	0DE	413.8375	6C6		67	404.8750	12C	414.3250	714
29	404.4000	0E0	413.8500	6C8		68	404.8875	12E	414.3375	716
30	404.4125	0E2	413.8625	6CA		69	404.9000	130	414.3500	718
31	404.4250	0E4	413.8750	6CC		70	404.9125	132	414.3625	71A
32	404.4375	0E6	413.8875	6CE		71	404.9250	134	414.3750	71C
33	404.4500	0E8	413.9000	6D0		72	404.9375	136	414.3875	71E
34	404.4625	0EA	413.9125	6D2		73	404.9500	138	414.4000	720
35	404.4750	0EC	413.9250	6D4		74	404.9625	13A	414.4125	722
36	404.4875	0EE	413.9375	6D6		75	404.9750	13C	414.4250	724
37	404.5000	0F0	413.9500	6D8		76	404.9875	13E	414.4375	726
38	404.5125	0F2	413.9625	6DA		77	405.0000	140	414.4500	728
39	404.5250	0F4	413.9750	6DC		78	405.0125	142	414.4625	72A
						79	405.0250	144	414.4750	72C

A.4 DCRS 450 MHz Band Plan (Defaults shown in **bold**)

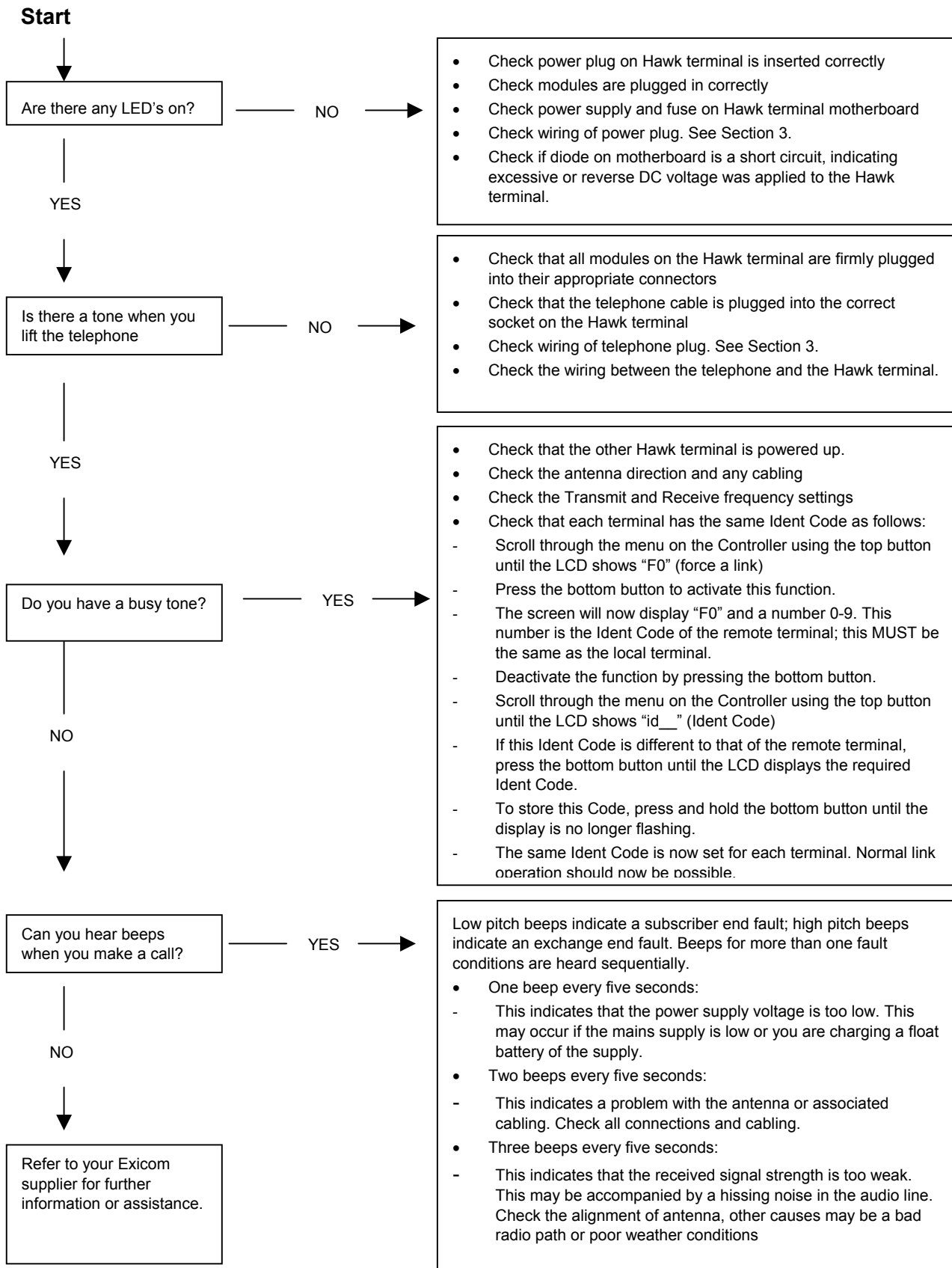
Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting	Channel Number	Tx Low (exchange) MHz	Switch Setting	Tx High (customer) MHz	Switch Setting
1	450.5125	052	460.0125	642	41	451.0125	0A2	460.5125	692
2	450.5250	054	460.0250	644	42	451.0250	0A4	460.5250	694
3	450.5375	056	460.0375	646	43	451.0375	0A6	460.5375	696
4	450.5500	058	460.0500	648	44	451.0500	0A8	460.5500	698
5	450.5625	05A	460.0625	64A	45	451.0625	0AA	460.5625	69A
6	450.5750	05C	460.0750	64C	46	451.0750	0AC	460.5750	69C
7	450.5875	05E	460.0875	64E	47	451.0875	0AE	460.5875	69E
8	450.6000	060	460.1000	650	48	451.1000	0B0	460.6000	6A0
9	450.6125	062	460.1125	652	49	451.1125	0B2	460.6125	6A2
10	450.6250	064	460.1250	654	50	451.1250	0B4	460.6250	6A4
11	450.6375	066	460.1375	656	51	451.1375	0B6	460.6375	6A6
12	450.6500	068	460.1500	658	52	451.1500	0B8	460.6500	6A8
13	450.6625	06A	460.1625	65A	53	451.1625	0BA	460.6625	6AA
14	450.6750	06C	460.1750	65C	54	451.1750	0BC	460.6750	6AC
15	450.6875	06E	460.1875	65E	55	451.1875	0BE	460.6875	6AE
16	450.7000	070	460.2000	660	56	451.2000	0C0	460.7000	6B0
17	450.7125	072	460.2125	662	57	451.2125	0C2	460.7125	6B2
18	450.7250	074	460.2250	664	58	451.2250	0C4	460.7250	6B4
19	450.7375	076	460.2375	666	59	451.2375	0C6	460.7375	6B6
20	450.7500	078	460.2500	668	60	451.2500	0C8	460.7500	6B8
21	450.7625	07A	460.2625	66A	61	451.2625	0CA	460.7625	6BA
22	450.7750	07C	460.2750	66C	62	451.2750	0CC	460.7750	6BC
23	450.7875	07E	460.2875	66E	63	451.2875	0CE	460.7875	6BE
24	450.8000	080	460.3000	670	64	451.3000	0D0	460.8000	6C0
25	450.8125	082	460.3125	672	65	451.3125	0D2	460.8125	6C2
26	450.8250	084	460.3250	674	66	451.3250	0D4	460.8250	6C4
27	450.8375	086	460.3375	676	67	451.3375	0D6	460.8375	6C6
28	450.8500	088	460.3500	678	68	451.3500	0D8	460.8500	6C8
29	450.8625	08A	460.3625	67A	69	451.3625	0DA	460.8625	6CA
30	450.8750	08C	460.3750	67C	70	451.3750	0DC	460.8750	6CC
31	450.8875	08E	460.3875	67E	71	451.3875	0DE	460.8875	6CE
32	450.9000	090	460.4000	680	72	451.4000	0E0	460.9000	6D0
33	450.9125	092	460.4125	682	73	451.4125	0E2	460.9125	6D2
34	450.9250	094	460.4250	684	74	451.4250	0E4	460.9250	6D4
35	450.9375	096	460.4375	686	75	451.4375	0E6	460.9375	6D6
36	450.9500	098	460.4500	688	76	451.4500	0E8	460.9500	6D8
37	450.9625	09A	460.4625	68A	77	451.4625	0EA	460.9625	6DA
38	450.9750	09C	460.4750	68C	78	451.4750	0EC	460.9750	6DC
39	450.9875	09E	460.4875	68E	79	451.4875	0EE	460.9875	6DE
40	451.0000	0A0	460.5000	690	80	451.5000	0F0	461.0000	6E0
					81	451.5125	0F2	461.0125	6E2

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Appendix B

Troubleshooting Guide

Refer over page for details of the troubleshooting guide.



Appendix C

Drilling Template for a Typical Cabinet¹

C.1 General

The drilling template overleaf details the positioning of the 4x M6 holes used when installing the Hawk wall mount terminal into a typical Telstra wall/pole/plinth Cabinet.

The terminal can be installed via four mounting brackets, using the Mounting Kit (containing 4x M6 screws and 4x M6 nutserts) that can be provided as part of the optional Auxiliary package.

C.2 Instructions

It is necessary to PHOTOCOPY the A3 Template prior to use. Once copied, it can be positioned as required within the interior of the Cabinet.

Once the Template is positioned, mark the centres of the 4x holes on the Cabinet (230mm apart) and drill suitable holes for the M6 screws/ nutserts.

- > Allow at least 5mm clearance from the Backboard to the head of each screw to mount the Terminal.

¹ Note that this Template can also be used when the Hawk wall mount Terminal is to be directly mounted to a wall; refer to Section 3.3 for details.

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Appendix D

Cable Pin Information – Quick Reference

This Appendix reproduces some of the Figures and Tables present in Section 3.6 of this Manual for quick reference.

D.1 Telephone Line Connections (SK101 to SK104)

Each Terminal is supplied with two cables that can be used for 2-wire or 6-wire connections as required. An RJ-11 connector is shown in Figure D.1 with the connector pin-outs identified in Tables D.1 (2-wire) and D.2 (6-wire)

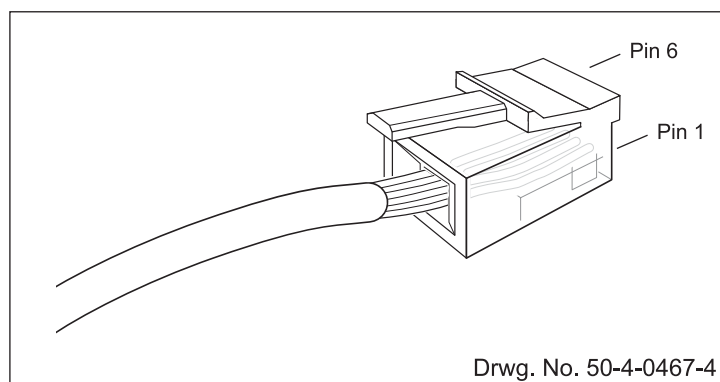


Figure D.1: RJ11 Connector for 2-wire or 6-wire Socket

D.1.1 2-wire Connection

SK103 (Channel A) and SK101 (Channel B) provide a 2-wire connection.

Pin	Signal	Wire Colour
1	Not connected	Blue
2 ¹	-ve Leg	Brown
3 ¹	Not connected	Brown/White
4 ¹	Not connected	Green/White
5 ¹	+ve Leg	Orange/White
6	Not connected	Blue/White

Table D.1: RJ-11 Pin-out's and colour coding for 2-wire connection

¹ Note that for 2-wire connectors SK101 and SK103 ONLY, pins 2/3 (+ve leg) and 4/5 (-ve leg) are physically connected on the Motherboard PCB. Therefore, pins 3 and 4 are not required for use.

D.1.2 4-wire + E and M connections

SK104 (Channel A) and SK102 (Channel B) provide a 4-wire + E and M connection.

Pin	Signal	Wire Colour
1	M-wire	Blue
2	Tx audio	Brown
3	Tx audio	Brown/White
4	Rx audio	Green/White
5	Rx audio	Orange/White
6	E-wire	Blue/White

Table D.2: RJ-11 Pin-out's and colour coding for 6-wire connection

D.2 Power Supply Connection (PL105)

A radio power cable is provided with each Terminal, as shown in Figure D.2.

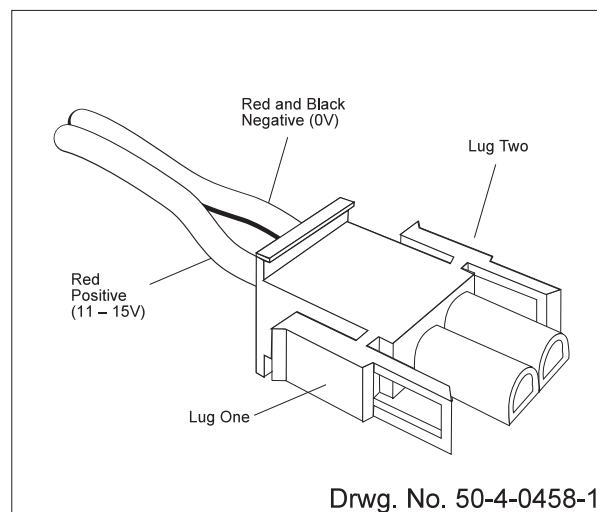


Figure D.2: Connector for the Power Supply Socket¹

¹ This connector is captive when inserted into the socket. To extract the connector, first push it fully home then press the two Lugs together while pulling the plug and cable out of the socket.

D.3 Link Fail Alarm Connection (SK105)

A Link Fail Alarm Cable can be supplied, wired as shown in Figure D.3, with the connector pin-outs identified in Table D.3.

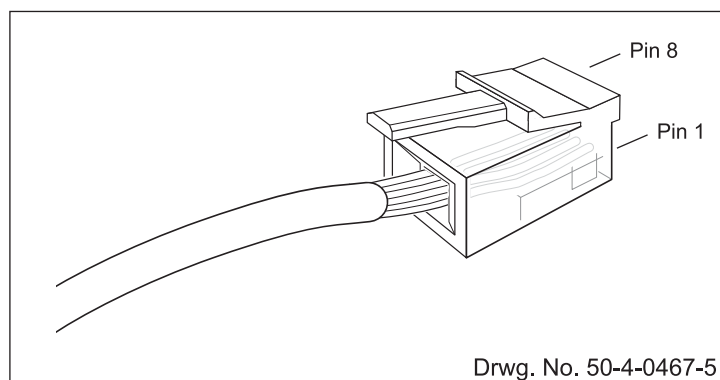


Figure D.3: RJ45 Connector for Alarm Output Socket

Pin	Signal	Wire Colour
1	Not connected	Green
2	Not connected	Orange
3	Not connected	Blue
4	Not connected	Brown
5	Not connected	Brown/White
6	RL1A pin 3 (normally open)	Green/White
7	RL1A pin 2 (normally closed)	Orange/White
8	Common	Blue/White

Table D.3: RJ-45 Pin-out's and colour coding for Alarm Cable connection

D.4 Datagate/modem connection (SK106)

There are two cables that can be supplied to connect to SK106 as follows:

D.4.1 Datagate/Modem to Hawk Controller Cable

A Datagate to Hawk Controller Cable can be supplied, wired as shown in Figure D.3, with the connector pin-outs identified in Table D.4.

RJ45 connector Pin#	Signal present at RJ45 Connector Pin	Wire Colour	DB25 Plug Pin#
1	Ground	Green	1
2	-	Orange	9
3	-	Blue	20
4	TxD	Brown	2
5	RxD	Brown/White	3
6	-	Green/White	6
7	+5V Out	Orange/White	Not Connected
8	Ground	Blue/White	7

Table D.4: RJ-45 Pin-out's and colour coding for Datagate/modem cable connection

D.4.2 Hawk Controller to PC Cable

A Hawk Controller to PC Cable can be supplied, wired as shown in Figure D.3, with the connector pin-outs identified in Table D.5.

This cable can be used in place of the Datagate/Modem to Hawk Controller Cable to allow connection of a laptop PC etc.

RJ45 connector Pin#	Signal present at RJ45 Connector Pin	DB9 Socket Pin#	Wire Colour
4	TxD	2	Brown
5	RxD	3	Brown/White
8	Ground	5	Blue/White

Table D.5: RJ-45 Pin-out's and colour coding for PC Cable connection



CAUTION

Pin 7 of the RJ45 connector supplies +5V. This pin must be left **unconnected** (as shown) if the Hawk is to be used with an ASCII dumb terminal or Laptop PC etc.

Appendix E

ASCII Character Set

A special wake up sequence is used when a modem is connected to the Controller's RS232 port. This prevents modem shut-down from inadvertently waking up the Hawk.

When accessing the Controller with a Laptop PC or VDT, a series of three key presses (after button wakeup) within a defined time is required; otherwise, the Hawk will shut down. The required key and acceptance time is user defined in Addresses 31 and 32¹

The value stored at address 31 defines an ASCII character for the key press required to wake up the Hawk. Values between 32 (space) and 126 (~) may be used. If 255 is stored at this location the function is disabled.

The value stored at address 32 defines the period (in seconds) that the three key presses must be within. The number at this address **must not** be less than two.

30 n/a	31 n/a	32 space	33 !	34 "	35 #	36 \$	37 %	38 &	39 '
40 (	41)	42 *	43 +	44 ,	45 -	46 .	47 /	48 0	49 1
50 2	51 3	52 4	53 5	54 6	55 7	56 8	57 9	58 :	59 ;
60 <	61 =	62 >	63 ?	64 @	65 A	66 B	67 C	68 D	69 E
70 F	71 G	72 H	73 I	74 J	75 K	76 L	77 M	78 N	79 O
80 P	81 Q	82 R	83 S	84 T	85 U	86 V	87 W	88 X	89 Y
90 Z	91 [	92 \	93]	94 ^	95 _	96 `	97 a	98 b	99 c
100 d	101 e	102 f	103 g	104 h	105 i	106 j	107 k	108 l	109 m
110 n	111 o	112 p	113 q	114 r	115 s	116 t	117 u	118 v	119 w
120 X	121 y	122 z	123 {	124 	125 }	126 ~	127 n/a	128 n/a	129 n/a

¹ Default settings are 65 (Address 31) and 5 (Address 32).

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Appendix F

Default software addresses

System parameters are stored at specific address locations within the EEPROM in the Type 8080 Controller module. The micro-controller reads the stored information to obtain the required figures.

A list of the address locations and the variables stored are shown in the non-volatile Memory Parameters table overleaf.

Refer to Section 2.11.3 for a full description of each function.

Note: Any codes not mentioned below are reserved and should not be changed.

The values stored are not lost if the power is removed from the Controller.

You can restore the EEPROM contents to the factory default settings by selecting the "Load Parameters" function. Refer to Section 2.11.1, "Local Functions".

Address #	Function	TELSTRA Default value
0-7	Serial number	Not adjustable.
8	Hardware configuration	Refer to Section 2.10.5
9	Ident code	Refer to Section 2.8
10	Point to Point configuration	Refer to Section 2.8
11-18	Password	Default password is TELSTRA
19,20	Micro-Controller idle time	246,0
21	Rx on time	60
22	Rx total cycle time	240
23	Identify timeout time	50
24	Max. Link establishment time	32
25	Max. Signal dropout time	100
26	RSSI cut-off ¹	Dependant on Rx module, see footnote 1 below
27	DSP power on time	50
29	Rx mute time ²	255 (see footnote 2 below)
30	Tx Hold time ²	255 (see footnote 2 below)
31	Wakeup key	65
32	Wakeup timeout	5
33	Diagnostic hold up time	12
35	Calling Line Identity	250
37	Link Check	240 (Exch) 255 (Customer)

¹ The RSSI cut-off figure is PRE-SET during factory testing for an Rx input level of -100 dBm. The resulting figure present in the RSSI meter reading 'r0' (refer to Section 2.6.4) is entered into Address 26. Any subsequent reduction in the RSSI level will mute the Receiver and start the signal dropout time.

² Addresses 29 & 30 MUST be set for the same value to avoid problems.

Address #	Function	TELSTRA Default value
40	Customer Terminal Minimum Dial Break	9
41	Customer Terminal Maximum Dial Break	18
42	Customer Terminal Minimum interdigit pause	30
43	Customer Terminal Maximum switch-hook flash	50
44	Payphone Hold Up Time	50
50	Exchange Terminal Flash-hook Duration	20
51	Exchange Terminal Dial Break Duration	13
52	Exchange Terminal Dial Make Duration	7
53	Exchange Terminal interdigit pause	120
54	Exchange Terminal Ring Time-out	105
58	Default Parameters	0

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Appendix G

Revision History

This Technical Manual is representative of the latest product to be supplied to Telstra and has been modified to include information regarding the following new product variants:

New Product	Previous Product	Detail
8081 Motherboard	2833 Motherboard	New variant, specific to the 8080 Controller module and the 8087 (Exch) or 8088 (Subs) Line Interface modules
8080 Controller	2832 Controller and (Channel A) Line Interface Module	New variant, Controller circuitry only (Channel A Line Interface circuitry now present on the 8087 (Exch) or 8088 (Subs) Line Interface modules)
8087 Exchange Dual Line Interface	2825 Line Interface (Channel B only)	New variant. Contains Dual Channel circuitry for 2-wire or 6-wire operation
8088 Subscriber Dual Line Interface	2825 Line Interface (Channel B only)	New variant. Contains Dual Channel circuitry for 2-wire (each Channel) and 6-wire operation (Channel A only)

Revision History

The following changes have been made to sections within this Manual:

	Section #	Previous Issue #	Superseded by Issue #	Brief detail of change
1	Section 4	Issue 0, November 2002	Issue 1, November 2002	Amendment to the Exchange Type 8087 and Subscriber Type 8088 DIPswitch settings regarding Positive or Negative M-wire configuration (refer to the corrected footnote on pages 4-8 and 4-10)
2	Section 1	Issue 0, November 2002	Issue 1, December 2002	Amendment to figures 1.2a and 1.2b to explain revised placement of connectors on rear of Terminal
3	Section 3	Issue 0, November 2002	Issue 1, December 2002	Amendment to figures 3.1, 3.2 and 3.5 and relevant text to explain revised placement of connectors on rear of Terminal
4	Section 4	Issue 1, November 2002	Issue 2, December 2002	Amendment to figures 4.1, 4.2 and 4.3 and relevant text to explain revised placement of connectors on rear of Terminal
5	Section 12	Issue 0, November 2002	Issue 1, December 2002	Amendment to relevant text to explain revised placement of connectors on rear of Terminal
6	Section 1	Issue 1, December 2002	Issue 2, January 2003	Replaced Figure 1.2b, to show amended DC input voltage label (refer Item 26 in picture)
7	ALL	Various	All increased as necessary. - refer to the next page for full details)	- Replaced Exicom logo within ALL Headers. - Removed (1996) from text within ALL Footers. - Changed copyright to 2003 - All of the above due to Exicom company name and logo change, effective January 2003

	Section #	Previous Issue #	Superseded by Issue #	Brief detail of change
8	Section 2	Issue 1, January 2003	Issue 2, March 2003	Amendment to Controller module Meter Reading sub-section 2.6.3 to show corrected c0 to c6 references and graphs
9	Section 3	Issue 2, January 2003	Issue 3, June 2003	Amendment to sub-sections 3.4 and 3.5 regarding inclusion of additional mounting washers
10	Section 2	Issue 2, March 2003	Issue 3, August 2003	Amendment to: CLI operation section 2.2.7, Audible Alarms section 2.2.8, Alarms 2.3.7 and meter reading r6 in section 2.6.4
11	Section 4	Issue 3, January 2003	Issue 4, September 2003	Reformatted tables in sections 4.7.3 and 4.7.4. Added RS232 port setup in section 4.8.2. Included measurement circuit and instructions in sections 4.9.2.
12	Section 2	Issue 3, August 2003	Issue 4, September 2003	Updated Telstra default software settings.
13	Appendix F	Issue 1, January 2003	Issue 2, September 2003	Updated Telstra default software settings.
14	Section 4	Issue 4 September 2003	Issue 5 December 2003	Added caution about continuous ringing on subscriber causing damage.
15	Section 7	Issue 1 January 2003	Issue 2 April 2004	Wide band VHF duplexer details added.
16	Appendix G		Issue 0 April 2004	Revision history appendix created.

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