

THIS SECTION introduces: -

Purpose, Form, Function and Specification.

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1 **BRIEF OVERVIEW**

1.1 **Introduction.**

The 3045x VOTER and LINE INTERFACE subsystem used in a multi-station PMR system to interface the Control Room (Console, Dispatcher) equipment to the lines or links connected to the Base Stations. It provides Best Signal Selection (Voting) and Transmitter Key steering in a number of configurable

options. Provision is made for the local connection of a Test Tone and Engineering Handset. Configuration and monitoring of status is generally via a Windows™ Engineering Terminal (ET) application (supplied) running on a standard PC (not supplied).

1.2 Operational Control and Monitoring.

There are facilities for both 'simple' and 'complex' super-ordinate system interfacing: -

- i In 'simple' systems the Voter can be operated and monitored by hard (dry contact) switching. Tx global key and selective key inputs of E & M style are available. Hard outputs showing the status of the voting process and link status are available.
- ii In 'complex' systems the Voter can be operated and monitored via RS232 link or via in-band two frequency shift signalling on the Console/Voter 4 wire I/O

1.3 Functions.

a. Talk-in ~ Return.

- i Votes on commonly available out of band Received Signal Strength Indicator tone.
- ii (Receiver mounted RSSI tone generator pcb is available separately).
- iii Voter algorithm configuration includes 'Hold' and 'Change on step-size'.
- iv Global RTN inhibit facility.

b. Talk-out ~ Go.

- i Transmitter key steering – Selection configurable.
- ii Incoming Key command by 2970Hz or E&M or signalling code or manual operation (toggle switches) or extended control of manual operation (extended controller pcb available but not supplied as standard inventory).
- iii Outgoing Key command by 2970Hz (optionally changing from a line proving tone) or E&M.

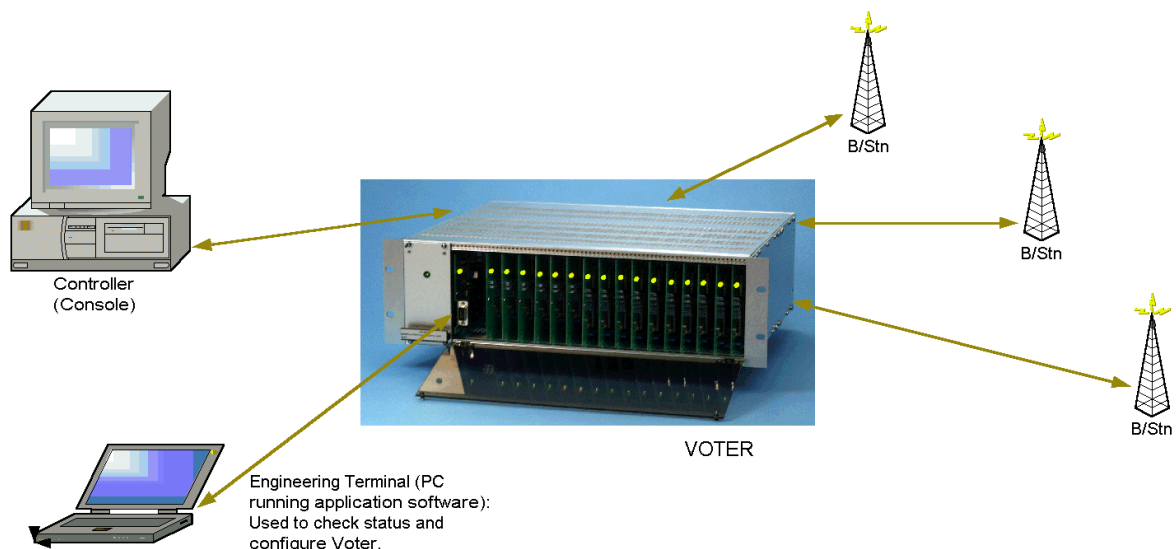
c. General.

- i Two models with different capacity ~ Single Voter x 16 Line and Dual Voter x 6 Line.
- ii Talk Through – Re-broadcast – facility.
- iii Engineer/Emergency handset connector (Handset available separately).
- iv 'Engineer Terminal' PC application software for configuration and interrogation included.

d. Signalling.

- i In-band two tone FSK signalling encoder and decoder is used to communicate with the Controller (Console) in standard and user specified optional protocols.
- ii Signalling transactions are generally with the Controller; however, provision has been made to pass Signalling through the unit to/from Controller and Base Station.
- iii The unit has an address in the Signalling context.
- iv The unit will respond to transmitter Key steering Signalling commands from the Controller.
- v The unit will initiate Signalling to inform the Controller of Voted site and other unit status.

1.4 System Installation Diagram. (VoterSysInstalBD.gif)



The Engineering Terminal is a maintenance tool and is only connected appropriately.

1.5 Presentation.

The equipment is presented as a 3U x 19" rack with application modules installed as required. Power requirement options are available as AC and a range of DC variants. All I/O, except local engineering, is via the rear panel. Connection requirement is 4 wire 600ohm at a nominal level of -10dBm.

1.6 Construction and Power Requirement.

The equipment is housed in a 3U x 19" rack shelf ~ there are 3 power options: -

- i AC Mains ~ 90VAC to 263VAC @ 47 to 440Hz 30VA (Fully fitted).
- ii 12 to 24VDC nominal ~ 10VDC to 36VDC 30VA (Fully fitted)
- iii 48VDC nominal ~ 36VDC to 72VDC 30VA (Fully fitted)

1.7 General Arrangement diagrams.

There are Single (16 Line) and Dual (6 Lines each) physical arrangements; arrangement diagrams can be found in Section 3 of this book.

2 SYSTEM AUDIO

Frequency (Traffic audio)	Range	250Hz to 2500Hz (3dB points)
	Response	+/-1dB ref. 1KHz ~ 400Hz to 2400Hz
Signal to Noise Ratio		
	GO With -10dB I/O	Better than 55dB
	RTN With -10dB I/O	Better than 55dB
Intra system level		-10dBm nominal
Intra system	I/O impedance	600ohm nominal
Internal system level – for Intra I/O levels as stated below.		2Vpp (700mVrms) at internal central test points
GO, Input sensitivity from Control Room	Range	-4dBm to -14dBm
GO, Output level to Line	Range	-1dBm to -15dBm
RTN, Input sensitivity from Line	Range	0dBm to -20dBm
RTN, Output level to Control Room	Range	-1dBm to -14dBm

3 HARDWARE INVENTORY ~ MECHANICAL DESCRIPTION

The inventory required to put a Voter into service: -

Item	Part number	Qty per installation
Voter rack: - Single Voter – up to 16 Lines. AC 110VAC to 240VAC DC 10VDC to 56VDC Dual Voters – up to 6 Lines each. AC 110VAC to 240VAC DC 10VDC to 56VDC	50450 50451 50452 50453	One of either – to suit application. Not including PSU module, see below.
Digital Control Module	40454	One (2 for Dual Voter)
Analogue Control Module	40455	One (2 for Dual Voter)
Line Module	40456	As required by application and within rack capacity
PSU Module; selected from the options: - AC 110VAC to 240VAC Nominal 10VDC to 36VDC Nominal 36VDC to 56VDC	40610 40611 40612	One of either – to suit application and rack type. (one only – Dual Voter uses only one PSU)

4 **SUPERVISION**

Engineering facilities are via the Engineering Terminal (ET) Windows application software supplied with the equipment ~ an IBM compatible PC on which to run ET software is not supplied. When connected the ET gives access to the system: -

- i Configuration and variable setting.
- ii Voter status.

5 **POWER FAIL**

In the event of a power failure the equipment will close down ~ there being no provision internally for uninterrupted operation. On resumption of supply the system will automatically re-activate.

6 **SOFTWARE AND FIRMWARE**

6.1 **Engineering PC programmes.**

The Engineering Terminal PC programme is distributed on the Technical Publications CD ROM, the latest updated copies are available on the Dalman website. Dalman retain the copyright of these programmes; however, users involved in the maintenance of the equipment may copy them freely.

6.2 **Firmware upgrades.**

Voter Control Module firmware upgrades are available from time to time; they are published on the Dalman web-site; the upgrade process is carried out 'on-site' via the Engineering Terminal.

7 **TALK-IN (RTN) PROCESSES**

7.1 **Input termination and level.**

Input from the Base Rx is via balance 600ohm Line/Link into a rear panel mounted DB9 connector – there is one connector for each Line. A manually operated level (front panel) control on each Line Module adjusts input sensitivity to system internal level.

7.2 **RSSI input, throughput and output.**

RSSI is routed to the decoder circuit. There is a facility to remove the RSSI tone from the traffic audio circuit or not as may be required; if the RSSI filter is by-passed the RSSI signal of the Selected RTN input will be passed with the traffic audio to the Controller (Console). The incoming RSSI is not available on the GO traffic audio; it is filtered off the Talk Through route.

The incoming RSSI tone will have been generated by an external system element – probably the Base Station Rx and is required in the form of a sliding or stepping tone in the range 2690Hz to 3030Hz. This tone is decoded tone as follows: -

Significance	Nominal Fc (Hz)	Approx. Spread (Hz)
Squelch closed (confidence)	2707	2690 to 2719
Squelch open 1	2730	2719 to 2761
Squelch open 2	2791	2761 to 2822
Squelch open 3	2852	2822 to 2983
Squelch open 4	2913	2983 to 2942
Squelch open 5 (Best Signal)	2972	2942 to 3030

7.3 **Best Signal Selection.**

Best Signal selection is based on selection of the highest frequency tone. There will always be a tone ~ the lowest tone is used to monitor the state of the return link; if there is no tone then the link is deemed to have failed. There are a number of configurable options: -

- i Select best and follow if RSSI level is > a configurable step size.

- ii As (i) above but with a configurable initial 'Hold'; this is to allow the flow of uninterrupted tone calling sequences.
- iii Hold initial selection until all Base Rx mute close then release.

7.4 All RTN Inhibit.

There is a configurable facility to de-select the RTN audio from all Line Modules (inhibit audio) when the Tx Key is ON ~ the purpose here is to facilitate the use of the Voter in simplex RF systems where the Base Rx is monitoring the Base Tx frequency. The duration of the silent period is configurable.

7.5 Signalling.

The Signalling process optionally reports to the Controller which Site was Selected when the Base Rx mutes all close, i.e. the report identifies voted site at the event of all mutes close.

The Signalling process optionally reports to the Controller the status of a return link. A code indicates link failure (no RSSI Tone) and another code indicates link satisfactory. There is only one occurrence of these codes at each event. The Voter can be interrogated by the Controller to report Link status. See also 'addressing the Voter' in the following Talk-out paragraph.

The Signalling stream from the Voter carries an identity that shows its origin (address). Signalling streams from a Base Station (that has been selected/voted) can be passed to the Controller.
(How do the Voter/Base Station data streams avoid each other? The stream from the Station will be accompanied by a Hi RSSI ~ the Voter report will not occur until all mutes close.)

7.6 Output termination and level.

Output to Control equipment is via balance 600ohm Line/Link into a rear panel mounted DB15 connector – the 'Facilities' connector. A manually operated level control adjusts output.

7.7 Indicators.

LEDs (tri-colour) on each Line Module show (there are actually 2 LEDs ~ the other is used to show GO status):-

- Green – tone being received (not necessarily mute lift)
- Amber – selected (voted).
- Red – no tone being received.

There are connectors on the rear panel to facilitate extended use of these indicators.

8 TALK-OUT (GO) PROCESSES

8.1 Output termination and level.

Output to the Base Tx is via balance 600ohm Line/Link into a rear panel mounted DB9 connector – there is one connector for each Line. A manual (front panel) control on each Line Module adjusts output level.

8.2 Transmitter Key Commands and Distribution.

a. From Controller (Dispatcher).

Commands to initiate Base Tx key may be received by the Voter as follows: -

- i Incoming 2970Hz tone mixed with the GO audio traffic stream.
- ii E and M signalling (closing contact (one side is set to 0V – Chassis - in the Voter)).
- iii Via a command string in the Signalling from Controller to Voter.

b. To Base Station Tx.

Commands to initiate Base Tx key are sent to the Base Tx as follows: -

- i Outgoing 2970Hz tone mixed with the GO audio traffic stream.
- ii E and M signalling (closing contact (one side is set to 0V – Chassis - in the Voter)).

The two options are not exclusive; however the 2970Hz tone method may be inhibited such that only the E&M appears to the outside; the E&M is always available, it is simply not connected if not required.

A switch on the Line Module can be used by engineers to send Key commands to the Base Tx. There are connectors on the rear panel to facilitate extended use of these switches.

c. Selective Distribution (Steering).

The instructions as to which selection to use are passed to the Control Module from the Controller via the Signalling process. Commands sent to initiate Base Tx key can be directed as follows: -

- i Key one, last voted site.
- ii Key group ~ 5 tables of Line Module numbers (Line Modules are numbered 1 to 16 (1 to 6 in Dual racks) according to their position in the rack) configured via ET.

Key Selection commands are sent to the Voter as required; the voter remains in the last Key Selection state until that command is superseded or the power is turned OFF.

See Engineering Terminal operation, Section 5, for detailed explanation of Tx Key Steering.

8.3 GO Confidence Tone.

There is a facility to send a 2850Hz tone to individual Base Stations while Tx Key is OFF. It is possible to have some Base Stations using this facility while others are not. This tone will be switched OFF when Tx Key (on that Line Module) is ON. The tone may be turned OFF by a Signalling command from the Controller.

8.4 Signalling.

The Signalling process accepts commands from the Controller. The Signalling stream to the Voter requires an address to identify the Voter. All Signalling streams are passed to the Line Modules and sent to the Base Station ~ whether or not there is a Tx Key command present.

8.5 Output termination and level.

Output to Control equipment is via balance 600ohm Line/Link into a rear panel mounted DB15 connector – the 'Facilities' connector. A manually operated level control adjusts output.

8.6 Indicators.

LEDs (3 colour) on each Line Module and the Control Module show: -

- i Line Module – one LED (there are actually 2 LEDs ~ the other is used to show RTN status):-
 - Green – not Tx Key
 - Amber – Tx Key.
- ii Control Module
 - Green – OK.
 - Flashing Amber – TT enabled.
 - Steady Amber – Tx Key.
 - Red – Control Room Line Failed (This is not a standard feature. Only operates on systems with appropriate FFSK signalling).

9 TALK THROUGH

9.1 Output termination and level.

The voter can be configured to operate TT. The action of a site being Selected (voted) will cause a Tx Key command to be issued (Key Selection in accordance with the key selection process). A configurable time period will hold the Key ON when all mutes close. See Section 5 for details.

There will be a facility to hold TT OFF for a configurable period if a specific code is received via Signalling from the Controller; this feature is pending the introduction of the Signalling process.

10 HANDSET AND TEST TONE.

10.1 Handset.

An Engineering Handset, connected to the Control Module can be used to put engineer GO and RTN audio on to the traffic audio circuit. There is a switch to connect the handset to either the GO or the RTN circuit ~ thus speaking to or monitoring either Base Station or Controller ~ is not possible to communicate in both directions at the same time. The handset connector does not have Tx Key facilities ~ it does have a microphone ON/OFF switch. If the engineer wishes to communicate with a mobile radio on the system then a Line Module (one or more) Tx Key switch must be used.

10.2 Test Tone.

The same connector and switch can be used to inject a test tone on to the traffic audio circuit.