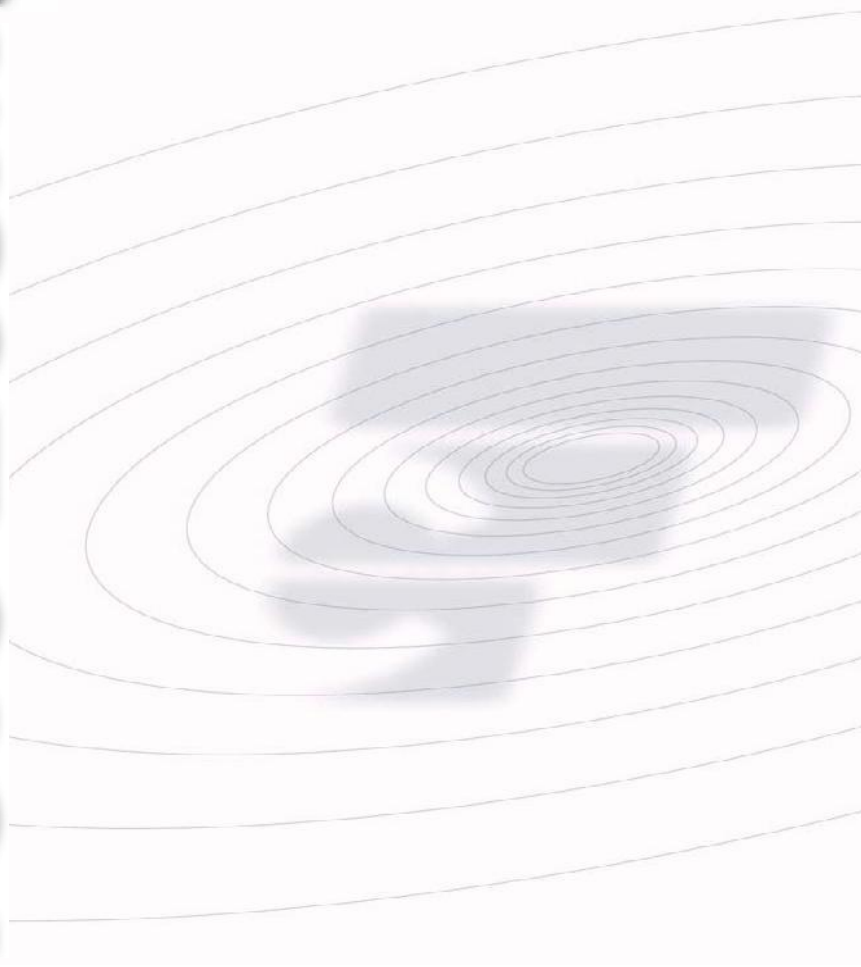


# MOBEXCOM P25



## DIGITAL VEHICULAR REPEATER

**FUTURECOM**



**User's Guide**

8A083X20 (6881013Y38-P) Rev 16

April 2014

## NOTES

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## Foreword

This manual provides User guidelines for all models of the Futurecom Mobexcom P25 Digital Vehicular Repeater (**DVR**). The DVR is designed to be interfaced to a Remote Mount Motorola XTL™5000 Mobile Subscriber Unit (**MSU**) with O3 or O5 Control Head or to a Remote Mount XTL™2500 with M5 Control Head.

When the DVR is interfaced to an XTL™2500 or XTL™5000 MSU, the complete equipment package is referred to as Digital Vehicular Repeater System (**DVRS**).

The DVR may also be used as a standalone (Tactical) repeater. The operation of the Tactical DVR is described in publication 8A083X21.

The DVR cannot be interfaced to XTL™5000 radios which are using the W-series control heads.

For W-series Control Head compatible equipment, please refer to the Mobexcom II Analog VR Documentation.

For details on the DVRS Installation and Programming Guidelines, please refer to publication 8M083X01.

For details on the XTL™5000 and XTL™2500 Mobile Radio operation, please refer to the applicable User's Manuals available from Motorola.

## Manual Revisions

| Revision # | Date       | ECN   | Notes & References                          |
|------------|------------|-------|---|
| 0          | 10/18/05   | na    | Original Release – Phase I                  |
| 1          | 12/14/05   | 05170 | Various updates                             |
| 2          | 1/11/06    | 06005 | Motorola Manual Number added                |
| 3          | 9/6/06     | 06183 | 380-430MHz operation added                  |
| 4          | 12/20/06   | 06246 | Phase II a operation update                 |
| 5          | 11/26/07   | 07175 | Phase II b operation update (App. 2.83)     |
| 6          | 09/30/2009 | 9085  | Application 3.00 update                     |
| 7          | 12/10/2009 | 9114  | Application 3.10 update                     |
| 8          | 04/23/2010 | 10030 | Application 3.20 update, Not released       |
| 9          | 11/12/2010 | 10055 | Application 3.22, customer specific release |
| 10         | 2/1/2011   | 11005 | Application 3.22, factory release           |
| 11         | 9/30/2011  | 11043 | Application 3.30 update                     |
| 12         | 1/18/2012  | 12005 | Application 3.31 update                     |
| 13         | 3/1/2012   | 12014 | MSU and APX PSU FW compatibility update     |
| 14         | 3/16/2012  | 12026 | Application 3.32 update                     |
| 15         | 9/28/2012  | 12078 | Application 3.40 update                     |
| 16         | 25/04/2014 | 14019 | Application 3.41 Update                     |



## Firmware

**The DVRS Operation described in this Document requires the following Firmware:**

XTL™2500 / XTL™5000 - firmware release: **Host R20.00.05**

XTS™1500 / XTS™2500 / XTS™5000 - firmware release **R17.01.01.**

APX™4000 / APX™6000 / APX™7000 – firmware release **R07.00.05 or later**

O3/O5/M5 Control Head - firmware release **R16.00.00**

DVR must be loaded with firmware release:

**Application 4C083X01 R03.41 or later**

Tweaker Programming software – Version **3.45** or later

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## Notations Used in This Manual

The following notations will be used throughout the text of this document:

**NOTE:**

A clarifying statement that expands on the text that follows.

**IMPORTANT!**

An important statement that should be considered and / or implemented in order to achieve adequate equipment operation.

**ATTENTION!**

An instruction that must be followed to insure compliance with the appropriate standards or proper equipment operations.

## Declaration of Conformity

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

### **FCC LABELS:**

**This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:**

- (1) This device may not cause harmful interference.**
- and**
- (2) This device must accept any interference received, including interference that may cause undesired operation.**

## RF Exposure

### **ATTENTION!**

Changes or modifications not expressly approved by Futurecom Systems Group, ULC. could void the User's authority to operate the equipment.

To satisfy FCC/IC RF exposure requirements for mobile transmitting devices, the minimum separation distances specified in the "RF Safety" Book (shipped with the DVRS) should be maintained. To ensure compliance, operations at closer than this distance is not allowed.

### **ATTENTION!**

Futurecom requires the P25 DVRS operator to ensure FCC Requirements for Radio Frequency Exposure are met. The minimum distance between all possible personnel and the body of the DVRS equipped vehicle is specified in the "RF Safety" book shipped with the DVR.

Failure to observe the Maximum Permissible Exposure (MPE) distance exclusion area around the antenna may expose persons within this area to RF energy above the FCC exposure limit for bystanders (general population).

It is the responsibility of the repeater operator to ensure MPE limits are observed at all times during repeater transmissions. The repeater operator must ensure at all times that no person comes within MPE distance from the vehicle body.

## Introduction

The P25 DVR allows Portable Subscriber Units (**PSU**) to be used in areas where only MSU coverage is available and PSU coverage is either intermittent or does not exist at all.

Installed in the trunk of a car, fire truck, armored vehicle, ambulance or configured as a Transportable or Fixed mount DVR, the P25 DVRS extends radio communications when the PSU users are outside of the vehicle, inside a nearby building or in any portable radio marginal coverage areas.

The P25 Digital Vehicular Repeater (**DVR**) is designed to be seamlessly interfaced to a Remote Mount XTL™2500 or XTL™5000 Digital Mobile Subscriber Unit (**MSU**) with **M5, O3 or O5** Control Head.

The DVR may also be used as a standalone (Tactical) repeater. The operation of the Tactical DVR is described in publication 8A083X21.

The DVR not only extends voice (clear or encrypted) communications but it also supports key trunking system features and can be configured to provide various advanced options to the Users.

The following table summarizes the DVRS compatibility scenarios:

| Portable Radio Type / Mode        | FIXED NETWORK TYPE / MOBILE RADIO MODE |                      |                                    |                       |
|-----------------------------------|--|----------------------|------------------------------------|-----------------------|
|                                   | Conventional Analog MSU                | Conventional P25 MSU | 3600 Analog / Digital Trunking MSU | 9600 P25 Trunking MSU |
| Conventional Analog PSU           | <b>YES</b><br>A                        | <b>YES</b><br>A/M    | <b>YES</b><br>A                    | <b>YES</b><br>A/M     |
| Generic Conventional P25 PSU      | NO                                     | <b>YES</b><br>D/M    | NO                                 | <b>YES</b><br>D/M     |
| DVRS Enabled Conventional P25 PSU | <b>YES</b><br>FA                       | <b>YES</b><br>D/FA/M | <b>YES</b><br>FA                   | <b>YES</b><br>D/FA/M  |

**Table 1 DVRS Compatibility Scenarios**

\*DVRS Channel Types:

A = Analog

D = Digital

M = Mixed

FA = Forced Analog

## Identifying Your DVRS Model

### Frequency Band of Operation

Depending on the frequency band of operation of the MSU and the interfaced DVR, the DVRS models are classified as follows:

- **In-Band** – when the MSU and DVR operate in the same frequency band.
- **Cross-Band** – when the MSU and DVR operate in two different frequency bands.

#### *In-Band*

The following **In-Band DVRS Model Groups** are available:

|  | <b>DVR BAND OF OPERATION [MHz]</b> |                                   |                                   |                                   |   |   |
|--|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---|---|
|  | <b>136-174</b>                     | <b>380-430</b>                    | <b>450-470</b>                    | <b>470-512</b>                    | <b>764-776<br/>794-806</b>                                | <b>806-825<br/>851-870</b>                                |
| <b>XTL™ 2500<br/>XTL™ 5000<br/>BAND OF<br/>OPERATION<br/>[MHz]</b> | <b>136-174</b>                     | <b>380-470<br/>OR<br/>450-520</b> | <b>380-470<br/>OR<br/>450-520</b> | <b>380-470<br/>OR<br/>450-520</b> | <b>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> | <b>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> |

Table 2 In-Band DVRS Models

#### *Cross-Band*

The following **Cross-Band DVRS Model Groups** are available:

|  | <b>DVR BAND OF OPERATION [MHz]</b>  |  |  |  |  |  |
|--|---|--|--|--|--|--|
|  | <b>136-174</b>  | <b>380-430</b>   | <b>450-470</b>   | <b>470-512</b>   | <b>764-776<br/>794-806</b>                           | <b>806-825<br/>851-870</b>                           |
| <b>XTL™ 2500<br/>XTL™ 5000<br/>BAND OF<br/>OPERATION<br/>[MHz]</b> | <b>380-470<br/>OR<br/>450-520<br/>OR<br/>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> | <b>136-174<br/>OR<br/>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> | <b>136-174<br/>OR<br/>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> | <b>136-174<br/>OR<br/>762-776<br/>794-806<br/>OR<br/>806-825<br/>851-870</b> | <b>136-174<br/>OR<br/>380-470<br/>OR<br/>450-520</b> | <b>136-174<br/>OR<br/>380-470<br/>OR<br/>450-520</b> |

Table 3 Cross-Band DVRS Models

#### **NOTE:**

The DVR can be interfaced to a High Power MSU, however, the Transmit power of the MSU must be reduced to comply with the maximum power restrictions described in the RF Safety Booklet, which is shipped with the DVR.

External power amplifiers can not be used.

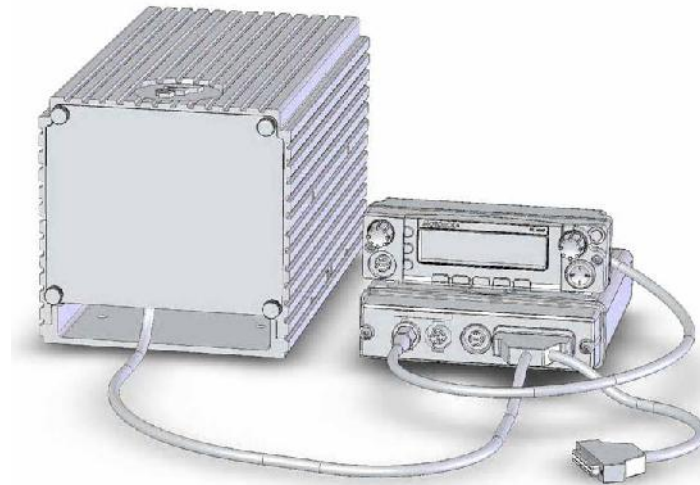
#### **NOTE:**

The In-Band filters connected to the MSU have typical insertion loss of 1.5dB.

## DVRS Mounting Arrangement

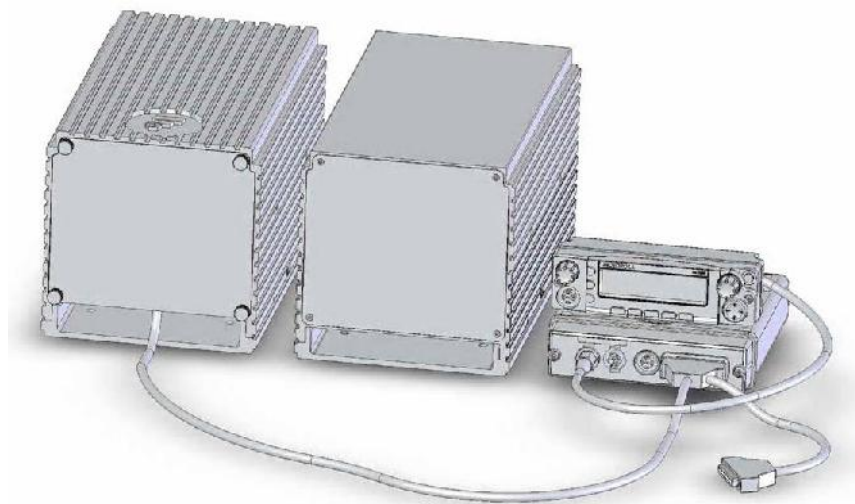
### *Side-By-Side DVRS*

Side-By-Side mounting is the standard option for vehicular type installations. The Cross-Band DVRS package includes a DVR Repeater and Duplexer Enclosure, mounted on one side and a Remote Mount MSU mounted next to the DVR.



**Figure 1 Typical Cross-Band DVRS Layout**

The In-Band models are comprised of a DVR Repeater and its associated filtering shelves mounted on one side, a model-specific in-band filtering shelf (shelves) mounted as close as possible to the DVR and a Remote Mount MSU mounted next to the in-band filtering.

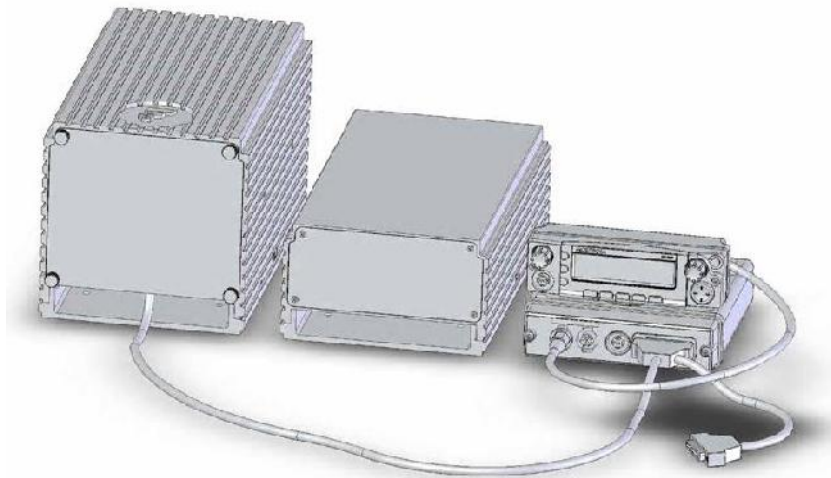


**Figure 2 Typical In-Band DVRS Layout - VHF**

**NOTE:**

The DVR and MSU always require two separate antennas.





**Figure 3 Typical In-Band DVRS Layout - 700 or 800 MHz**

### ***Transportable DVRS***

The Transportable DVRS is packaged in a durable suitcase and includes all necessary electronics and filtering. The Transportable unit can be easily deployed in the field and is powered up either by plugging into an AC outlet or by using an optional battery backup kit.

The battery backup kit is also packaged in a suitcase for ease of transportation.

The Transportable Model requires two antennas - one connected to the MSU and one to the DVR.

The MSU antenna needs to be strategically deployed in order to ensure reliable link between the MSU and the Radio System Infrastructure.

The DVR antenna needs to be positioned to provide optimum radio coverage for the portable radio users. For further details, please refer to publication 8F083X02.

### ***Fixed DVRS***

The Fixed DVRS model is housed in a wall-mount indoor enclosure and includes all necessary electronics and filtering. The Fixed DVRS is intended for permanent i.e. 'Fixed' type installations. For further details, please refer to publication 8F083X01.



**Fixed DVRS**



**Transportable DVRS (TDVRS)**



**Battery Pack  
for TDVRS**

## DVRS Operation Basics

### **IMPORTANT!**

The Operation of the DVRS is determined by the following:

- Firmware Options and Programming settings of the DVR (DVR personality).
- Firmware Options and Programming settings of the XTL™2500 / XTL™5000 interfaced to the DVR.
- Configuration Capabilities and Programmed settings of the Radio System.
- Type and Programming settings of the Portable Radios used for communications through the DVR.

### **IMPORTANT!**

Depending on the selected Personality Settings and Configuration Capabilities of the complete Radio System Infrastructure, the Options described throughout this document may or may not be applicable to the specific DVRS operation.

## DVRS Features by PSU Type

When the PSU User is out of System Radio Coverage, the PSU can be switched to a dedicated DVR channel so that the PSU can communicate via the DVRS. The features available to the PSU User depend on the PSU type, programming and selected mode. The table below specifies what features are supported by the different PSU types.

| PSU FEATURE SUPPORT BY DVRS                        | DVRS Enabled PSU [Note 5] | Generic P25 PSU | Analog PSU    |
|--|---------------------------|-----------------|---------------|
| REGISTRATION / DEREGISTRATION                      | Yes                       | Yes [Note 1]    | No [Note 3]   |
| TALK GROUP PROXING/TRANSLATION                     | Yes                       | Yes             | No            |
| GROUP CALL   | Yes                       | Yes             | Yes           |
| PRIVATE CALL                                       | Yes                       | No              | No            |
| EMERGENCY CALL/ALARM                               | Yes                       | Yes             | Yes           |
| P25 ENCRYPTION                                     | Yes                       | Yes             | No            |
| CALL ALERT   | Yes                       | Yes             | No            |
| FAILSOFT / OUT OF RANGE / SITE TRUNKING INDICATION | Yes                       | No              | No            |
| LOCAL MODE INDICATION                              | Yes                       | No              | No            |
| TALK PERMIT TONES (GENERATED BY PSU)               | Yes                       | No              | No            |
| TRAILING TONES SENT BY DVR                         | No                        | No              | Yes           |
| RADIO INHIBIT                                      | Yes                       | Yes             | No            |
| RADIO CHECK  | Yes                       | Yes             | No            |
| P25 TRUNKING OTAR                                  | Yes                       | No              | No            |
| ADAPTIVE POWER CONTROL                             | Yes                       | No              | No            |
| PHONE INTERCONNECT                                 | Yes                       | No              | No            |
| PATCH  | Yes                       | No              | No            |
| DYNAMIC REGROUPING                                 | Yes                       | No              | No            |
| EMERGENCY ID PASS THROUGH                          | Yes                       | Yes             | Yes [Note 2]  |
| PSU HOT MIC  | Yes [Note 4]              | No              | No            |
| EMERGENCY REVERT                                   | Yes                       | Yes             | Yes           |
| PSU SCAN   | No                        | No              | No            |
| REMOTE DVR ACTIVATION via CALL ALERT SENT BY PSU   | Yes                       | Yes             | No            |
| REMOTE DVR ACTIVATION VIA DTMF SENT BY PSU         | No                        | No              | Yes           |
| REMOTE DVR ACTIVATION via PSU EMERGENCY ALARM      | Yes                       | Yes             | Yes (MDC1200) |

**Table 4 DVRS Features vs Type of PSU**

Note 1 When selecting a DVR Mode on the Generic P25 PSU, it registers upon first Group Call. Generic PSU is deregistered after a preprogrammed timer counting the period of inactivity expires.

Note 2 Supported only with MDC1200 capable portables.

Note 3 Analog PSU is registered on the P25 system with its MDC1200 ID if PSU Emergency (MDC1200) is initiated.

Note 4 Requires firmware R12.00.13 or later in the PSU.

Note 5 The PSU models that can be programmed as **DVRS Enabled** are listed in **Table 6**

## Powering up the DVRS

The DVR powers up together with the MSU.

The Power up Mode and Channel are programmable.

Depending on the programmed personality, the DVR can power up in one of the following states:

- DVR Disabled Mode, last selected DVR channel
- OFF Mode
- SYSTEM Mode, last selected DVR channel
- SYSTEM Mode, preprogrammed DVR channel
- LOCAL Mode, last selected DVR channel
- LOCAL Mode, preprogrammed DVR channel
- If the DVRS powers up on a 'Slaving enabled' mobile radio channel, the DVR will be steered according to the Talk Group selected on the MSU. The steering may involve both DVR Channel and mode change.

### **NOTE:**

For a detailed description of the DVRS Modes of Operation, please refer to the **DVRS Modes of Operation** paragraph of this document.

## Turning ON the DVRS

When the MSU is powered up, the DVRS can be activated by one or more of the methods described in the following section.

The DVR is ON when SYSTEM (or optionally LOCAL) Mode of operation is selected.

The DVR is OFF when OFF Mode is selected on the O3/O5/M5.

The DVR is disabled when a “DVR Disabled” Mode / Channel is selected on the O3/O5/M5.

### **NOTE:**

For Operation details on the O3/O5/M5 Control Head and XTL™ 2500 / XTL™ 5000 Mobile Radios, please refer to the applicable User's Manuals provided by Motorola.

### **NOTE:**

The DVR can only be activated when a “DVR Enabled” Mode / Channel is selected on the O3/O5/M5 – see ‘DVRS Enabled’ Mobile Radio TGs / Channels.

## Activating the DVRS via the Control Head

Ensure the MSU is powered up and a DVR Enabled TG / Channel is selected on the Control Head.

To activate the DVR, press the VRS Menu Item (Softkey) or the assigned VRS Button if available.

Pressing the VRS Button allows the User to enter the “DVR Control Mode” and to select the desired DVR Mode and DVR Channel as described in the **Selecting DVRS Mode** and **Selecting DVRS Channel** Paragraphs.

Executing a long VRS button press activates the DVR and toggles its Permanent Primary Status if such is programmed to be selectable by the User.

For detailed description of the Permanent Primary notation, please refer to the **Primary / Secondary DVR Basics** section of this document.

## Automatic DVRS Activation (AVRA)

The DVR can be activated automatically (switched from OFF or LOCAL to SYSTEM Mode) if one of the VIP inputs on the MSU control head is wired to the desired trigger source – portable charger switch or door switch or custom manual switch. If the selected MSU or DVR channel is programmed as ‘LOCAL only’, then AVRA will cause OFF to LOCAL mode switch.

When the DVR is in the OFF or LOCAL mode and the VIP input is asserted by the installed trigger, the DVR will automatically switch to the SYSTEM mode.

*For instance, removing the portable radio from the charger before leaving the vehicle may be set up to automatically activate the DVR (i.e. switch it to SYSTEM Mode).*

If the DVR is in the SYSTEM mode asserting the VIP output through the installed trigger switch will not cause any change of the DVR status.

### **IMPORTANT!**

**The DVR can be activated only if a ‘DVR Enabled’ TG / Channel is selected on the Control Head of the MSU.**

## Remote Activation of the DVRS

### *Via Call Alert (Page) to DVR*

**NOTE:**

This feature requires the use of a P25 PSU and implies Digital DVRS Mode of operation.

To remotely activate a DVR, the PSU user can send a Call Alert (Page) with the ID of the specific DVR.

Upon receipt of a Call Alert (Page) from the PSU the DVR will:

- Switch from OFF or LOCAL mode to SYSTEM Mode (unless it is already in the SYSTEM Mode). If the selected DVR / MSU channel is programmed as LOCAL only, the DVR will switch from OFF to LOCAL mode.
- Switch to Primary Status and force any other Primary DVR to become a Secondary unless there is a Permanent Primary (on the same DVR channel) already present in the same area.
- Force the MSU to revert to a TG selected on the PSU (as enabled by the DVR and PSU programming).

### *Via PSU Emergency Alarm*

The DVR switches from OFF to SYSTEM Mode after a programmable number of Emergency Alarm attempts sent by a PSU are successfully received by the DVR and are not serviced by another (Primary) DVRS.

### *Via PSU DTMF Tones*

To remotely activate a DVR (Analog Mode), the PSU user can send a preprogrammed DTMF sequence, which can be received by DVRS in the PSU radio coverage area.

Upon receipt of the preprogrammed DTMF sequence from the PSU the DVR will:

- Switch from OFF or LOCAL mode to SYSTEM Mode.
- Switch to Primary Status unless there is already a Primary / Permanent Primary DVRS (on the same DVR channel) already present in the same area.

DTMF Activation is supported on Analog or Mixed mode DVR channels only.

### *Via System / Dispatcher Call Alert Page to MSU*

There are two methods for Dispatcher initiated DVRS mode change depending on the MSU and DVRS programming.

If remote mode change is enabled in the MSU & System Console, the DVRS mode can be switched remotely when the Dispatcher sends a Call Alert (Page) to a specific MSU (using the MSU ID). The use of this feature assumes that the Call Alert (Page) function is disabled in all other subscriber units and reserved for Dispatcher use only in order to prevent random switching of the DVRS mode during unit-to-unit Call Alert. Switching OFF an active DVRS may compromise the safety of the PSU users currently relying on radio communications through this DVRS.

The recommended method is to have the remote mode change disabled in the MSU. The DVRS can then be programmed with the console's Unit ID (or range of IDs) and only pages received by the MSU from those programmed unit IDs when received by the MSU will cause DVRS mode toggle. This way the call alert feature can be used in the

rest of the system subscriber units without any danger of unintentionally switching a DVRS mode.

In both cases, Dispatcher sends a Call Alert (Page) to a specific MSU ID, which in turn causes DVR mode change in the following order: OFF-SYS-LOC-OFF with each received Page.

The DVRS sends status updates to the Fixed Network Equipment System for each mode change (P25 Trunking systems only!).

The status updates are sent in the following format:

Status 1 = OFF mode

Status 2 = LOCAL mode

Status 3 = SYSTEM mode

Dispatcher cannot force a Non-Primary DVR to become a Primary and cannot activate a DVR when a 'VR Disabled' mode is selected on the control head.

**The MSU needs to have the same unit ID programmed for all DVRS enabled systems/modes in order to have reliable remote mode change operation via Call alert page to MSU.**



## Turning OFF the DVRS

### Deactivating the DVRS via the MSU Control Head

Do the following:

- Execute single presses of the VRS Menu Item (Softkey) until OFF Mode is displayed  
**OR**
- Select a 'DVR Disabled' TG / Mode / Zone  
**OR**
- Power down the MSU if radio operation is no longer required.

### Deactivating the DVRS via Call Alert sent by Dispatch

There are two methods for Dispatcher initiated DVRS mode change depending on the MSU and DVRS programming.

If remote mode change is enabled in the MSU & System Console, the DVRS mode can be switched remotely when the Dispatcher sends a Call Alert (Page) to a specific MSU (using the MSU ID). The use of this feature assumes that the Call Alert (Page) function is disabled in all other subscriber units and reserved for Dispatcher use only in order to prevent random switching of the DVRS mode during unit-to-unit Call Alert. Switching OFF an active DVRS may compromise the safety of the PSU users currently relying on radio communications through this DVRS.

The recommended method is to have the remote mode change disabled in the MSU and the DVRS can then be programmed with the console Unit ID (or range of IDs) and only pages of those unit IDs when received by the MSU will cause DVRS mode toggle. This way the call alert feature can be used in the rest of the system subscriber units without any danger of unintentionally switching a DVRS mode.

In both cases, Dispatcher sends a Call Alert (Page) to a specific MSU ID, which in turn causes DVR mode change in the following order: OFF-SYS-LOC-OFF with each received Page.

The DVRS sends status updates to the Fixed Network Equipment System for each mode change (P25 Trunking systems only!).

The status updates are sent in the following format:

Status 1 = OFF mode

Status 2 = LOCAL mode

Status 3 = SYSTEM mode

Dispatcher cannot force a Non-Primary DVR to become a Primary and cannot activate a DVR when a 'VR Disabled' mode is selected on the control head.



## **Automatic DVRS Deactivation**

### ***AVRA***

If the DVR is in the SYSTEM or LOCAL Mode and the AVRA VIP input is de-asserted, the DVR can be programmed to automatically switch to OFF Mode.

If the DVR is in the OFF Mode, de-asserting the AVRA VIP will not result in any change. The method of de-asserting the AVRA VIP depends on the actual installed AVRA trigger.

*For example, if the selected AVRA trigger is the Portable Charger Switch, de-asserting the AVRA VIP input is equivalent to placing the PSU back in the charger.*

### ***Inactivity Timer***

If programmed, the DVR can switch automatically to OFF Mode upon expiration of its Inactivity Timer (programmable from 0 to 180 minutes). The timer is restarted every time the DVR detects PSU activity.

## DVRS Status Display

The following O3/O5 Display Icons / Messages relate to the DVRS operation:













| O5 DISPLAY ICON / MESSAGE  | DVRS STATUS DESCRIPTION   |
|--|---|
| Steady      | DVR is in a Primary State   |
| Steady      | Primary DVR Receiving   |
| Steady      | Primary DVR Transmitting  |
| Steady      | Primary DVR Receiving and Transmitting  |
| Flashing    | DVR is in a Secondary State   |
| Flashing    | Secondary DVR Receiving   |
| Steady      | DVR is in a Permanent Primary State   |
| Flashing  | DVR is in a Permanent Primary on Standby (there is another Permanent Primary already present in the area) |
| Flashing  | Permanent Primary on Standby Receiving  |
| Steady    | Permanent Primary Receiving   |
| Steady    | Permanent Primary Transmitting  |
| Steady    | Permanent Primary Receiving and Transmitting  |
| <b>VR SERVICE</b>  | DVR is in Service Mode (during re-flashing of the firmware).  |
| <b>VR ERROR</b>  | DVR Detected Error. Display toggles between VR ERROR and the actual error code / number.                  |
| <b>VR IN RESET</b>   | DVR is being reset  |
| <b>VR DISABLED</b>   | DVR Disabled on Selected MSU TG / Mode  |

Table 5 DVRS Status Display Messages / Icons

## DVRS Enabled PSUs

The following Portable Radios have enhanced firmware that allows enhanced communications with the DVR and support of an extended list of features.

| PSU Models that can be 'DVRS Enabled' | PSU Firmware Revision Required   |
|---------------------------------------|--|
| XTS™1500                              | R9.00.00 and higher<br><b>Note: It is highly recommended to always use the latest released PSU firmware to ensure all fixes and new features are included.</b> |
| XTS™2500                              |  |
| XTS™5000                              |  |
| APX™4000                              | R7.00.05 and higher  |
| APX™6000                              |  |
| APX™7000                              |  |

**Table 6 DVRS Enabled PSU Models**

All other P25 capable PSU models or the above models with either older firmware versions or when not programmed as 'DVRS Enabled', can only be programmed as 'P25 Generic' since they are not capable of extended communications with the DVR.

## DVRS Status Tones

### DVRS Status Tones - MSU Speaker

The following DVRS Specific Tones will be heard in the MSU Speaker under the circumstances described below:

| TONE TYPE   | TONE NAME                | DVRS STATUS  |
|---|--------------------------|--|
| Short high-pitched tone   | VRS Button Press         | Indicates a valid VRS Button press during DVRS Selection Mode.   |
| Short low-pitched tone  | DVR Invalid Option       | Indicates Invalid DVR Selection (for example when pressing the VRS Button while a "DVRS Disabled" TG/Channel is selected on the O3/O5/M5).   |
| Long high-pitched tone  | DVR Control Timeout      | Indicates the end of DVR Control Mode session. The last DVR settings (DVR Channel, DVR Mode, Permanent Primary Status) selected by the User and displayed on the O3/O5/M5 become active.   |
| Two low-pitched tones   | DVR Denied               | Operation denied due to programming restriction. For instance – pressing and holding the VRS button to activate Permanent Primary when this function is not enabled in the programmed personality will trigger 'DVR Denied' tones. |
| Chirping Sound (prior to MSU Firmware R16.00.01)<br>Single High Pitched Beep (MSU R16.00.01 and up) | Permanent Primary ON/OFF | Indicates Permanent Primary ON/OFF.  |
| Single high-pitched tone every few seconds (5-255 sec. programmable)                                | DVR Active               | Indicates the DVR is either in SYSTEM or LOCAL Mode (programmable). The 'DVR Active' Tones are heard in both Primary and Secondary DVR Modes.  |

**Table 7 DVRS Status Tones (MSU Speaker)**

## DVRS Status Tones - PSU

### *P25 'DVRS Enabled' PSU*

The following DVRS-only specific tones are available (if programmed) in the P25 PSU:

| STONE TYPE                        | STONE NAME                   | DESCRIPTION  |
|-----------------------------------|------------------------------|--|
| Series of short beeps             | Go Ahead System (clear)      | DVRS system mode talk permit tone, clear voice   |
| Series of short beeps             | Go Ahead System (secure)     | DVRS system mode talk permit tone, encrypted (secure) voice  |
| Series of short beeps             | Go Ahead Local (clear)       | DVRS local mode talk permit tone, clear voice  |
| Series of short beeps             | Go Ahead Local (secure)      | DVRS local mode talk permit tone, encrypted (secure) voice   |
| Low pitched tone every 30 seconds | Low Car Battery              | Sent by the DVRS when the Car Battery voltage is below the programmed threshold  |
| Series of short beeps             | Queued Call                  | Call has been queued, waiting for system grant   |
| Two short beeps                   | No Activity Timer Expiration | Warning tones sent to alert the PSU users that the DVR will switch from SYS/LOC to OFF. Sent every minute for the last 5 minutes prior to the switching. |
| Three beeps                       | DVR Active                   | Tones sent upon DVRS activation (SYS or LOC mode).   |

**Table 8 P25 DVRS Enabled PSUs – DVRS Specific Tones**

### *Generic P25 PSUs*

'Low Car Battery', 'No Activity Timer Expiration' and 'DVR Active' tones (as described in Table 8 above) are supported.

### *Conventional Analog PSUs*

The DVR in analog mode can be configured to send the following tones to the analog PSUs:

| TONE TYPE  | TONE NAME                           | DESCRIPTION  |
|--|-------------------------------------|--|
| Beep   | Encrypted Call                      | Sent to Local Analog PSUs when the MSU is receiving Encrypted Call. The beeps are sent until the encrypted call ends.  |
| Three Short Beeps  | Leading Go Ahead                    | Leading tones sent by the DVR over the air upon receipt of system grant. Requires the LPSU User to do 'double PTT' in order to get a channel and release the PTT to be able to receive the Leading Tones.  |
| Long Low pitched tone  | Leading Deny                        |  |
| Single high-pitched tone                                     | Trailing Successful System Access   | Trailing Tones sent by DVR in analog mode to conventional analog PSUs at the end of PSU transmission. If the transmission was unsuccessful the PSU User will know that He / She needs to repeat the message if they want to reach the System. Lack of Trailing tones would indicate that the PSU User is outside of the DVR range. |
| Longer Low pitched tone                                      | Trailing Unsuccessful System Access |  |
| Single Low pitched tone every 30 seconds                     | Low Battery                         | The Low Battery tones are sent to the local portables every 30 seconds when the battery voltage drops below the programmed threshold.  |
| Single Low pitched tone                                      | Trailing - Access Denied            | Indicates System was busy and the portable radio call was only repeated locally.   |
| Programmable or default (3 short beeps)                      | Emergency ACK                       | If programmed, emergency ACK tones are sent by the DVR when processing MDC1200 emergency issued by a PSU.  |
| Two short beeps  | No Activity Timer Expiration        | Warning tones sent to alert the PSU users that the DVR will switch from SYS/LOC to OFF. Sent every minute for the last 5 minutes prior to the switching.   |
| Programmable number of tones, tone duration and frequencies. | DVR Activation                      | If programmed, DVR generated tones are sent to the PSUs every time the DVR is activated i.e. switched to LOCAL or SYSTEM Mode.   |

**Table 9 Analog PSU - DVRS Specific Tones**

**NOTE:**

All PSUs which are in the Analog Mode DVR radio coverage area and switched to the DVR channel will hear the DVR status tones since those are transmitted over the air (on the same frequency /PL/DPL) and are NOT generated by the portable radios.

## **‘DVRs Enabled’ Mobile Radio TGs / Channels**

DVR Operation may be enabled (by the DVR and MSU programming) on selected Mobile Radio Talk Groups / Channels and disabled on others.

When the User selects a DVRs Enabled TG / Channel on the O3/O5/M5 Control Head, the DVR Operation is enabled in the following manner:

- The DVR automatically enters the pre-programmed DVR Mode/Channel associated (‘Strapped’) with the selected MSU TG / Channel if DVR Strapped Operation is programmed in the DVR.

OR

- The User may change the DVR Mode / Channel (if ‘strapping’ is not enabled) by pressing the assigned VRS Button and entering the DVR Control Mode.
- The DVR can be activated and used to repeat messages between the System Users of the TG/Channel Selected on the MSU and the PSU users on the Selected DVR Channel.
- If enabled in the DVR personality, ‘DVR Enabled’ tones will be heard every few seconds (5-255 sec. programmable) in the MSU speaker, regardless of the Primary / Secondary status.

## **‘DVRs Disabled’ Mobile Radio TGs / Channels**

DVR Operation may be enabled on selected Mobile Radio Talk Groups / Channels and disabled on others.

When the User selects a “DVRs Disabled” TG / Channel on the Control Head:

- Pressing the VRS button results in a DVR Invalid Option Tone (single low-pitched tone).
- DVR Operation is prohibited i.e. all DVR functions are disabled.
- Call Alert Page from the Local PSU, sent on the last used DVR channel, can steer the MSU to a ‘VR Enabled’ mode if programmed accordingly.

## DVRS Modes of Operation

When a “DVRS Enabled” TG / Channel is selected on the O3/O5/M5 Control Head, the DVR can be switched to one of the following Modes – OFF, LOCAL or SYSTEM.

### OFF Mode

| ACTIVITY                         | OFF MODE ACTION  |
|----------------------------------|--|
| O3/O5/M5 Display                 | VR OFF <DVR CH Name>   |
| VRS Button Press                 | Short high-pitched tone.<br>DVR Control Mode is accessible.              |
| MSU Receiving from System        | DVR does not repeat audio received by MSU.<br>Speaker Audio present.     |
| MSU User PTTs the MSU Microphone | MSU Keys up. DVR does not key up.  |
| PSU Activity on DVR channel      | DVRS Transmit Function Disabled i.e.<br>No DVR repeat. No Speaker Audio. |

Table 10 OFF Mode DVRS Basic Operation

### SYSTEM Mode

| ACTIVITY                         | SYSTEM MODE ACTION   |
|----------------------------------|--|
| O3/O5/M5 Display                 | VR SYS <DVR CH Name>   |
| DVRS Active Tones                | If programmed, a short high-pitched ‘DVR Enabled’ tone is repeated every few seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Primary / Secondary Status of the DVR. |
| VRS Button Press                 | Short high-pitched tone.<br>DVR Control Mode is accessible.  |
| MSU User PTTs the MSU Microphone | Both DVR and MSU key up.<br>DVR can be programmed to not key up!   |
| MSU Receiving from System        | DVR repeats audio received by MSU to PSU Users of the designated DVR Channel.<br>Speaker Audio is present.   |
| PSU Activity on DVR channel      | PSU audio is repeated locally by DVRS as well as by the MSU to the System. MSU Speaker Audio is present if In-Car Monitor is enabled in the DVR.   |

Table 11 SYSTEM Mode DVRS Basic Operation

#### **NOTE:**

If the selected DVR channel attribute is programmed as Simplex or Half Duplex, the local voice repeat DVR function is not available. If proxying and In-Car Monitor are enabled and the TG selected by the Local PSU is different from that selected on the MSU, then Inbound or Outbound speaker audio will be present only if the microphone is OFF Hook and the HUB feature is enabled.



## LOCAL Mode

| ACTIVITY                         | LOCAL MODE ACTION  |
|----------------------------------|--|
| O3/O5/M5 Display                 | VR LOC <DVR CH Name>   |
| DVRS Active Tones                | If programmed, a short high-pitched 'DVR Enabled' tone is repeated every few seconds (5-255 sec. programmable) in the MSU Speaker regardless of the Primary / Secondary Status of the DVR. |
| VRS Button Press                 | Short high-pitched tone.<br>DVR Control Mode is accessible.  |
| MSU Receiving from System        | DVR may be programmed to repeat audio received by MSU to the PSU Users over the DVR Channel when the DVR is idle. Speaker Audio present.   |
| MSU User PTTs the MSU Microphone | DVR keys up. MSU may or may not key up depending on MSU programming.   |
| PSU Activity on DVR channel      | PSU audio is repeated locally by DVRS. Speaker Audio is present if In-Car Monitor is enabled in DVR.   |

**Table 12 LOCAL Mode DVRS Basic Operation**

## Selecting DVRS Mode

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the User may enter the 'DVRS Control Mode' by pressing the assigned VRS button on the Control Head and change the DVRS Mode / Channel / Status as described below:

### Selecting DVRS Mode from the Control Head

To change the DVRS Mode:

- Execute a Single Press of the assigned VRS Button / Softkey and observe the display flashing.
- Execute consecutive single VRS button presses to toggle the DVRS Mode until the desired Mode appears on the Control Head Display.
- Once the desired Mode is displayed discontinue pressing the VRS button and observe the DVR 'Control Mode' time out. The DVR Control Timeout tone (long high-pitched tone) will be heard in the MSU speaker and the display will stop flashing.
- The last selected (i.e. last displayed on the Control Head) DVR Mode is in effect.

### Strapped DVRS Mode

The DVRS Mode and Channel may be programmed to be 'Strapped' to the specific MSU TG/Channel.

In this case, selecting a specific MSU TG / Channel on the Control Head would automatically force the DVR to revert to a pre-programmed DVR Mode and/or Channel.

*For example, selecting a DVR Enabled TG named 'DISPATCH' on the MSU may automatically force the DVR to switch to DVR Channel 1, SYSTEM Mode.*

If enabled in the specific DVR personality programming, the DVRS User can still toggle the DVR Mode by pressing the VRS Button and entering the 'DVR Control Mode'.

If Mode change by the User is prohibited in the specific DVRS personality, the User can only select between the 'Strapped' (either LOCAL or SYSTEM) and OFF DVR Modes.

## Selecting DVRS Channel

When a 'DVRS Enabled' TG / Channel is selected on the MSU, the User may enter the 'DVRS Control Mode' by pressing the assigned VRS button on the O3/O5/M5 Control Head and then change the DVRS Mode / Channel / Status as described below:

### Independent DVRS Channel Change

To change the DVRS Channel:

- Execute a Single Press of the assigned VRS Button / Softkey and observe the display flashing.
- Turn the Control Head Mode selection Knob until the desired DVR Channel appears on the Display.
- If the VRS button is not pressed for 3 seconds the DVR Control Timeout tone (long high-pitched tone) will be heard in the MSU speaker and the display will stop flashing.
- The last selected (i.e. last displayed on the O3/O5/M5) DVR Channel (and Mode) is in effect.

### Strapped DVRS Channel Change

The DVRS Mode and Channel may be programmed to be Strapped to the specific MSU TG/Channel.

In this case, selecting a specific MSU TG / Channel would automatically force the DVR to revert to a given DVR Channel and/or Mode.

*For example, selecting a DVR Enabled TG named 'DISPATCH' on the O5 may automatically force the DVR to switch to DVR Channel 1, SYSTEM Mode.*

When Strapping is enabled and the DVR channel follows the MSU TG/mode selection, the User may still be allowed (if enabled by the DVR programmed personality) to change the DVR channel by pressing the VRS soft key and then turning the mode knob.

#### **NOTE:**

Depending on the specific DVR personality programming, the DVR Channel selection may be restricted to a short list of allowed DVR channels (or no Channel selection options at all). If Channel Strapping is enabled then the DVR will always land on the specified Strapped DVR channel first even when more than one channels are on its allowed channels list.

*For example, when TG named 'DISPATCH' is selected on the O5, the DVR automatically lands on DVR CH 1 and the User may be allowed to toggle between DVR Channels 1 and 4 while the selection of DVR channels 2 and 3 may be prohibited.*

## Primary / Secondary DVR Basics

In order to prevent interference and loss of communications when more than one active DVRS are present at the same location and tuned to the same DVR Channel, a sophisticated simulcast prevention algorithm is employed to ensure only one DVRS repeats radio communications on the same DVR frequency at the same time.

While the algorithm is transparent to the User, on some occasions he/she may need to be able to select (or simply be aware of) which DVRS is currently the 'Primary' and which ones are 'non-Primaries'. Furthermore, a DVRS may be assigned to be a Permanent Primary. A Permanent Primary always wins the voting algorithm. If more than one Permanent Primaries are activated simultaneously, they vote to ensure only one DVR remains as a Permanent Primary and the other(s) revert to standby mode. The simulcast prevention algorithm ensures that there will always be one active Primary DVRS regardless of when any of the DVRS arrive / leave the scene or are switched ON/OFF.




|                   | PRIMARY  | STANDBY  | PERMANENT PRIMARY  |
|-------------------|--|--|--|
| <b>DEFINITION</b> | An active DVR which has won the voting selection and has been selected to repeat Local PSU or System Communications. | An active DVR which was voted off and forced to stay on stand-by, without repeating for as long as the elected Primary DVR is servicing the communication needs in the area. | An active DVR, which is forced by the User or programmed to act as a Primary. The Permanent Primary forces all other DVRS in the area to assume Secondary status. If more than one Permanent Primaries are available in the same area, they will go through higher level voting to elect one winning Permanent Primary among them. |
| <b>SELECTION</b>  | Transparent to the User Selection via DVRS voting algorithm.   | Transparent to the User Selection via DVRS voting algorithm.   | Long press (3s) of the VRS button on the O5 Control Head toggles the Permanent Primary Status ON and OFF if this selection is enabled in the DVRS personality.   |
| <b>O5 DISPLAY</b> | Steady                            | Flashing   | Steady    |

Table 13 Primary DVR Definitions


**NOTE:**

As an option, an external light may be placed on the top of the vehicle, which can be used to indicate which DVRS is the currently selected Primary.

The Primary / Secondary Status of a DVR is re-evaluated every time one of the following takes place:

- Change of DVR Channel Frequency
- Change of DVR Mode
- Remote Activation of another DVR
- Selecting a DVR Disabled TG / Channel on the O5
- Powering down a DVRS
- Detected presence or absence of another Primary
- User enforced Permanent Primary Status

### **Permanent Primary Activation**

To force a DVR into Permanent Primary Status, press and hold the VRS button for 3 seconds, until “PERM MASTR ON” message appears on the Control Head display and the Permanent Primary ON/OFF tone is heard in the MSU speaker. The Permanent Primary Icon  will appear on the Control Head Display.

#### **NOTE:**

If another Permanent Primary is already present, the newly activated Permanent Primary DVR will force the “old” Permanent Primary to assume Permanent Primary ‘On Standby’ Status. If the Permanent Primary leaves the scene, the Permanent Primary ‘On Standby’ takes over. If several Users try to simultaneously activate several DVRS as Permanent Primaries, the DVRS will go through voting to ensure only one Permanent Primary DVR is selected and all other DVRS are forced to become Permanent Primaries ‘On Standby’.

### **Permanent Primary Deactivation**

Manual change from Permanent Primary to Primary Status can be executed by pressing and holding the VRS button for 3 seconds on the Control Head until:

- The Permanent Primary ON/OFF tone is heard in the MSU speaker and the “PERM MASTR OFF” message appears momentarily on the Control Head display.
- The “Permanent Primary” icon changes to “Primary”.

### **Multiple DVRS Operating on Different DVR Frequencies**

If more than one DVRS are present at the same location at the same time and they are set to operate on different DVR RF Frequencies, the DVRS may operate independently.

For example, DVRS A may be set to operate on DVR CH 1 (F1/F2) and TG X while DVRS B may be set to DVR CH 2 (F3/F4) and TG Y.

Local PSU User can select DVR CH 1 and talk to TG X Users through DVRS A.

Local PSU User can select DVR CH 2 and talk to TG Y Users through DVRS B.

Both DVRS A and DVRS B will be Primaries i.e. each DVRS will be the Primary on its selected DVR channel.

### **Legacy Mobexcom II Voting Compatibility Mode**

If Voting Compatibility mode is enabled in the DVR, it can be deployed to operate alongside Legacy Mobexcom II analog VRs. The voting compatibility mode is applicable to analog DVRS mode only.

## MSU Scan

When the MSU is programmed (recommended) to suspend SCAN when DVR is ON, the following SCAN scenarios are possible:

If the DVR is in the SYSTEM or LOCAL Mode and the MSU User presses the SCAN button on the Control Head he /she hears an invalid button press tone and the SCAN function does not become active.

If the DVR is OFF or Disabled, the MSU User can press the SCAN button and activate the SCAN function.

Once the MSU is in SCAN:

- If the DVR Mode is changed from OFF to SYSTEM or LOCAL, the SCAN is suspended.
- If the DVR Mode is changed back to OFF, the SCAN resumes.

If the MSU is programmed to allow both SCAN and DVR to be activated at the same time, the following rules apply:

- If the MSU lands on a mode which is compatible with the selected DVR channel then outbound calls are repeated to the Local PSUs.
- If the MSU lands on a mode which is not compatible with the selected DVR channel then the DVR is disabled and the outbound call is not repeated to the Local PSU.
- Inbound call from the Local PSU has higher priority and returns the MSU to the originally selected mode.

### **NOTE:**

When SCAN and DVR operation is allowed (by MSU programming), the strapping of DVR channels to MSU modes must be disabled.

## P25 Digital Mode

This Chapter provides details on the DVRS Digital P25 Mode of operation.

The P25 Digital Mode assumes the following:

- XTL™ 5000 MSU with O3 or O5 Programmed for DVRS Operation  
OR
- XTL™ 2500 MSU with M5 Programmed for DVRS Operation
- P25 Mode is selected on the MSU.
- P25 PSU programmed for DVRS operation (Local PSU).
- DVRS Enabled mode selected on the Local PSU.
- DVR Channel is programmed in the DVR for Digital (or Mixed) Mode of Operation.

### **NOTE:**

The basic principles of DVRS operation (both Analog and Digital) are as described in the **DVRS Operation Basics** Chapter. This Chapter focuses only on features specific to the Digital Mode of operation.

### **NOTE:**

The **Local PSU** Notation throughout this Chapter refers to a P25 PSU which is programmed for DVRS operation.

'**DVRS Enabled**' type Local PSU refers to the models described in **Table 6** when programmed for DVRS operation.

Some of the Digital Mode DVRS Features described are only available in P25 'DVRS Enabled' type PSUs and not available in Generic P25 PSUs.

A **System PSU** refers to a P25 PSU which has a P25 Mode (Trunking or Conventional) selected and 'talks' to the P25 Trunking or Conventional System Infrastructure directly i.e. without a DVRS.

In in-band DVRS applications, the **Local** and **System PSUs** may be of the same model and personality. When a DVR Enabled P25 Mode is selected, the PSU is referred to as **Local PSU**. When a P25 System TG / Channel is selected, the PSU is referred to as **System PSU**.

In Cross-Band DVRS applications, the **Local PSUs** operate in different frequency band from the System infrastructure.

## Digital Mode – Summary of Features

### Digital DVR Mode With P25 Trunking Mode Selected on MSU

| FEATURE  | DVR OFF Mode     | DVR SYSTEM Mode   | DVR LOCAL Mode  |
|--|------------------|---|---|
| DVRS Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>  | VR SYS <DVR CH>   | VR LOC <DVR CH>   |
| PSU Affiliation  | No               | Yes   | Yes   |
| Talk Group Proxing / Translation                         | No               | Yes   | Yes   |
| Outbound Group Call                                      | No               | Yes   | Programmable  |
| Outbound Private Call                                    | No               | Yes   | Yes   |
| MSU Microphone PTT                                       | Keys up MSU only | Keys up both MSU and DVR.<br>(DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No               | Yes   | Yes (Local side)  |
| Inbound Private Call                                     | No               | Yes   | Yes   |
| Inbound Call Alert                                       | No               | Yes   | Yes   |
| Talk Permit Tones - PSU                                  | No               | Yes   | Yes   |
| Inbound Emergency Alarm & Call                           | Yes*             | Yes   | Yes   |
| Remote DVRS Activation & Steering                        | Yes – Call Alert | Yes – Call Alert  | Yes – Call Alert  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | No               | Yes   | No  |
| Local Mode Indication - PSU                              | No               | No  | Yes   |
| DVR Primary / Secondary Voting                           | No               | Yes   | Yes   |
| DVR Tones – MSU Speaker                                  | No               | Yes   | Yes   |
| Radio Inhibit - PSU                                      | No               | Yes   | Yes   |
| Radio Check - PSU  | No               | Yes   | Yes   |
| P25 Trunking OTAR - PSU                                  | No               | Yes   | Yes   |
| Patch  | No               | Yes   | Yes   |
| Dynamic Regrouping                                       | No               | Yes   | Yes   |
| Phone Interconnect                                       | No               | Yes   | Yes   |
| Adaptive Power Control - PSU                             | No               | Yes   | Yes   |
| Emerg. ID Pass Through                                   | Yes*             | Yes   | Yes   |
| Audio Buffering  | No               | Yes   | Yes   |
| P25 Encryption   | No               | Yes   | Yes   |

\* After activation.



## Digital DVR Mode With P25 Conventional Mode Selected on MSU

| FEATURE  | DVR OFF Mode     | DVR SYSTEM Mode  | DVR LOCAL Mode  |
|--|------------------|--|---|
| DVRS Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>  | VR SYS <DVR CH>  | VR LOC <DVR CH>   |
| PSU Affiliation  | No               | Yes  | Yes   |
| Talk Group Proxing / Translation                         | No               | Yes  | Yes   |
| Outbound Group Call                                      | No               | Yes  | Programmable  |
| Outbound Private Call                                    | No               | Yes  | Yes   |
| MSU Microphone PTT                                       | Keys up MSU only | Keys up both MSU and DVR. (DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No               | Yes  | Yes (Local side)  |
| Inbound Private Call                                     | No               | Yes  | Yes   |
| Inbound Call Alert                                       | No               | Yes  | Yes   |
| Talk Permit Tones - PSU                                  | No               | Yes  | Yes   |
| Inbound Emergency Alarm & Call                           | Yes*             | Yes  | Yes   |
| Remote DVRS Activation & Steering                        | Yes – Call Alert | Yes – Call Alert   | Yes – Call Alert  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | NA               | NA   | NA  |
| Local Mode Indication - PSU                              | No               | No   | Yes   |
| DVR Primary / Secondary Voting                           | No               | Yes  | Yes   |
| DVR Tones – MSU Speaker                                  | No               | Yes  | Yes   |
| Radio Inhibit - PSU                                      | No               | Yes  | Yes   |
| Radio Check - PSU  | No               | Yes  | Yes   |
| P25 Trunking OTAR - PSU                                  | NA               | NA   | NA  |
| Patch  | NA               | NA   | NA  |
| Dynamic Regrouping                                       | NA               | NA   | NA  |
| Phone Interconnect                                       | No               | No   | No  |
| Adaptive Power Control - PSU                             | No               | Yes  | Yes   |
| Emerg. ID Pass Through                                   | Yes*             | Yes  | Yes   |
| Audio Buffering  | No               | Yes  | Yes   |
| P25 Encryption   | No               | Yes  | Yes   |

\* After activation.



## PSU Affiliation

When a Local P25 PSU User selects a DVR Enabled TG, the Local PSU is affiliated via an active Primary DVRS if:

- The DVR is programmed for Digital (or Mixed) mode on the selected DVR channel.
- The same Digital DVR channel is selected on both the PSU and the DVRS.

Generic P25 PSU is registered during the first Group Call made after switching to the DVR Mode.

'DVRS Enabled' P25 PSU starts automatic affiliation process upon selection of DVR Enabled Mode (no PTT required to start affiliation process).

If there are more than one DVRS present in the area and all are switched to the same RF channel, only one of them will be elected as a Primary and will service the coverage needs of all Local PSUs.

If the Primary DVR is switched OFF or leaves the scene, another active DVR (if present and if switched to the same RF channel) will take over by changing its status from Secondary to Primary and the Local PSUs will be affiliated via the new Primary.

## Inbound Group Call

When a Local PSU is affiliated with a specific TG, the User can PTT the Local PSU and talk to:

- Other Local PSU users, which are affiliated with the same TG (not available in Half Duplex DVR Mode).
- System Users affiliated with the same TG - SYSTEM DVR mode

The audio is heard in the MSU Speaker when In Car Monitor is Enabled and if:

- The Local PSU and DVRS/MSU are on the same TG.
- The Local PSU and DVRS/MSU are on different TGs (proxing is enabled), the MSU microphone is OFF Hook and the HUB Feature is enabled in the DVRS and MSU.

## Inbound Private Call

An affiliated Local PSU User can make a Private Call to:

- Another affiliated Local PSU User (not available in Half Duplex DVR Mode).
- An affiliated System User (MSU or PSU)

Private Calls are not heard in the MSU Speaker unless the Private Call is directed to the specific MSU.

## Inbound Call Alert

An affiliated Local PSU can send a Call Alert (Page) to:

- An affiliated Local PSU.
- An affiliated System PSU.

## Outbound Group Call

All calls received by the MSU on the currently selected TG (on the O3/O5/M5) are heard in the MSU speaker and repeated by the DVRS to the Local PSUs affiliated with the same TG.

If the selected TGs are not matched (and proxing is enabled), the outbound audio will be heard in the MSU speaker only if the HUB feature is enabled and the MSU microphone is OFF hook.

## Outbound Private Call

An affiliated System User can make a Private Call to a Local affiliated PSU through an active DVRS.

## MSU Mic PTT

When the MIC PTT is activated and the DVR is in the SYSTEM Mode, the DVR may be programmed to either transmit the MIC audio to the system (by MSU) and locally (by DVR) OR only to the system (by MSU).

In the LOCAL Mode, Microphone PTT keys up the DVR and may be programmed to key up the MSU as well.

### **NOTE:**

Microphone PTT has higher priority over DVR repeat.

## In-Car Monitor

If In-Car Monitor is enabled in the DVR, the audio received from the Local PSUs will be heard in the MSU speaker if the TG selected on the PSU is the same as the TG selected on the MSU.

If the TG selected on the Local PSU is different from the one selected on the MSU (see **Talk Group Proxing**), the voice received from the Local PSU will not be heard on the MSU speaker unless the Hook Switch (HUB) feature is enabled in the DVR and the Microphone is currently Off Hook.

Private Calls are never heard on the MSU speaker regardless of the Hook Switch (HUB) status unless the Private Call involves the particular MSU.

Outbound Calls, received by the MSU are heard in MSU speaker when the TG selected on the MSU is the same as the TG selected on the Local PSU (or one of the currently affiliated Local PSUs via the specific DVR). If the selected TGs are not matched, the outbound audio will be heard in the MSU speaker only if the HUB feature is enabled and the MSU microphone is OFF hook.

## Talk Group Proxing

The Local PSU User can change the selected 'DVRS Enabled' TG and seamlessly talk to the corresponding TG Users through the DVRS. The MSU can be on any 'DVRS Enabled' TG, which may or may not match the TG selected by the Local PSU.

*For example, if the Local PSU selects TG1 while the MSU is on TG2, the Local PSU can talk to Local TG1 users as well as System TG1 Users via the DVRS i.e. the MSU will be transmitting on TG1. However, if the MSU microphone is PTT-ed, both the MSU and the DVR will transmit on the TG selected on the MSU i.e. TG2.*

## Talk Group Translation

When TG translation is enabled in the DVR for a Local PSU TG ID, then the Local PSU affiliates on the TG currently selected on the MSU control head. Effectively the Local

PSU can stay on the same TG / mode and if the MSU TG is set to TG A, the Local PSU talks / receives TG A, when the MSU TG is changed to TG B then the Local PSU receives / talks on TG B etc.

**TG Translation requires that TG Proxing is enabled.**

If TG Proxing is enabled but the Local PSU is on a TG that is not in the DVRS TG Translation list then the DVRS will proxy any inbound / outbound calls.

Outbound call (System call) received on the currently selected MSU TG is repeated 'as is' i.e. without any translation.

Patch can not be supported on PSU TGs that are programmed for TG Translation.

MSU Patch is supported as follows:

Inbound call from PSU on TG Translation enabled TG will be translated to the patch supergroup and repeated locally and to the system.

Outbound call will be repeated as is (with the supergroup TG ID).

## PSU Talk Permit Tones

'Go Ahead' tones are generated in the 'DVRS Enabled' PSUs (see **Table 6**). Different tones are generated to indicate if the DVRS is in Local or System Mode and if the call is clear or encrypted. As a programming option Local Mode tones can be generated when the System is busy and only Local repeat is available. Alternatively, the PSU user can get 'System Busy' tones and be forced to wait for system grant.

Generic P25 PSU mode does not support Talk Permit Tones when operating through the DVRS.

## Inbound Emergency Call / Alarm

When an affiliated Local PSU issues an emergency Alarm, the active Primary DVR will process the emergency to the system as follows:

If the '**Portable ID Display**' box (in the DVR **Emergency Mode Setup**) is checked, the Local PSU Unit ID will be displayed on the O5 / O3 / M5 of the current Primary DVRS.

The PSU Unit ID will also appear on the display of the other Local PSUs if they are programmed accordingly.

During Emergency Call, the Unit ID of the Local PSU, which has initiated the Emergency Call, may be displayed on the System PSUs / MSUs if those are programmed accordingly.

The Local PSU ID during Emergency may also be displayed on the Dispatcher Console.

The DVR sends back an Emergency ACK to prevent the PSU from re-sending the Emergency either right after the DVR decodes the Emergency request (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to "VR Ack") or after a System ACK has been received (if the '**System Acknowledge Type**' on the **Mobile Radio Channel Settings** menu is set to 'Site Ack' or 'Console Ack' ).

All Secondary DVRS in the area are monitoring the number of emergencies issued by Local PSUs according to the '**Attempts Timeout**' and '**Attempts Counter**' settings programmed in the DVRS **Emergency Mode Setup**. If the number of detected not serviced Emergency Attempts exceeds the counter, the Secondary DVRS will go through Primary / Secondary voting to select a new Primary to pass the emergency to the System.

If a DVRS is in the OFF Mode when it receives an Emergency from a Local PSU, the DVR will switch to System Mode after the '**Attempts Counter**' is exceeded, affiliate the PSU and process the Emergency to the System.

The PSU Emergency attempts counter must be programmed to be equal to the DVRS '**Attempts Counter**' plus 3.

### **IMPORTANT!**

**Hot Mic operation is only supported on DVRS Enabled PSUs that are loaded with firmware R12.00.13 or later. Please check with Motorola for compatibility.**

### **NOTE:**

If the Primary DVR receives a PSU emergency while busy servicing an Outbound Call, the Emergency will be given higher priority and the Outbound call will be interrupted.

### **Emergency operation during TG Translation**

Emergency operation is affected by TG Translation as follows:

**Inbound Emergency Alarm** received by the DVRS on TG X will be translated and repeated locally on all TG IDs that are selected on Local PSUs, which are currently affiliated with the DVRS. The Emergency Alarm is also translated to the ID of the TG selected on the MSU and forwarded to the System.

**Outbond Emergency Alarm** received by the DVRS on TG Y (elected on the MSU) will be translated and repeated to the Local PSUs on all TG IDs that are selected on Local PSUs, affiliated with the DVRS at the time.

**Inbound Emergency Call** on TG X will be translated by the DVRS to the ID of the TG selected on the MSU and will be repeated locally on the translated TG.

**Outbound Emergency call** received on TG Y (selected on the MSU) will be repeated by the DVRS to the Local PSUs on TG Y.

If Emergency Revert is programmed in the Local PSU then:

If the revert TG is on the DVRS TG Translation list, then the Emergency will be translated to the ID of the TG that is selected on the MSU. Local repeat will be on all TG IDs that are selected on Local PSU that are affiliated with the DVRS and that are in the DVRS TG translation list.

If the revert TG is not in the DVRS TG Translation list then the emergency will be proxied and the inbound, outbound and local repeat will be on the new emergency revert TG.

If the MSU (interfaced to the Master DVR) is placed in Emergency and programmed to revert in Emergency then a subsequent Local PSU emergency will also be declared and translated on the MSU's emergency revert TG.

## Remote Steering via Call Alert Page to DVR

A Local PSU User can send a Call Alert (Page) to a specific DVRS and execute a remote change of the following:

- DVR Mode – from OFF or LOCAL to SYSTEM
- DVR Status – from SECONDARY to PRIMARY
- MSU Mode – steered from the originally selected (on the Control Head) TG to the TG selected by the Local PSU.

The following table provides examples of typical steering scenarios:

| Local PSU   | DVRS A Steering  |  | DVRS B Steering   |  |
|---|--|--|---|--|
|   | BEFORE   | AFTER  | BEFORE  | AFTER  |
| Call Alert Page to:<br><br>DVRS A<br>PSU on TG 1  | OFF OR<br>LOCAL<br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1     | <b>SYSTEM</b><br><br><b>PRIMARY</b><br><br>DVR CH 1<br>MSU TG 1  | LOCAL OR SYSTEM<br><br>PRIMARY<br><br>DVR CH 1<br>MSU TG 1          | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>SECONDARY</b><br><br>DVR CH 1<br>MSU TG 1     |
| Call Alert Page to:<br><br>DVRS A<br>PSU on TG 1  | OFF OR<br>LOCAL<br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1     | <b>SYSTEM</b><br><br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1       | LOCAL OR SYSTEM<br><br>PERM. PRIMARY<br><br>DVR CH 1<br>MSU TG 1    | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>PERM. PRIMARY</b><br><br>DVR CH 1<br>MSU TG 1 |
| Call Alert Page to:<br><br>DVRS A<br>PSU on TG 2  | OFF OR<br>LOCAL<br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1     | <b>SYSTEM</b><br><br><b>PRIMARY</b><br><br>DVR CH 1<br>MSU TG 2  | LOCAL OR SYSTEM<br><br>PRIMARY<br><br>DVR CH 1<br>MSU TG 1          | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>SECONDARY</b><br><br>DVR CH 1<br>MSU TG 1     |
| Call Alert Page to:<br><br>DVRS A<br>PSU on TG 2  | OFF OR<br>LOCAL<br><br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1 | <b>SYSTEM</b><br><br>SECONDARY<br><br>DVR CH 1<br>MSU TG 2       | LOCAL OR<br>SYSTEM<br><br>PERM. PRIMARY<br><br>DVR CH 1<br>MSU TG 1 | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>PERM. PRIMARY</b><br><br>DVR CH 1<br>MSU TG 1 |
| Call Alert Page to:<br><br>DVRS A<br>PSU on CONV1 | OFF OR<br>LOCAL<br>SECONDARY<br><br>DVR CH 1<br>MSU TG 1     | <b>SYSTEM</b><br><br><b>PRIMARY</b><br><br>DVR CH 1<br>MSU CONV1 | LOCAL OR<br>SYSTEM<br>PRIMARY<br><br>DVR CH 1<br>MSU TG 1           | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>SECONDARY</b><br><br>DVR CH 1<br>MSU TG 1     |
| Call Alert Page to:<br><br>DVRS A<br>PSU on TG1   | OFF OR<br>LOCAL<br>SECONDARY<br><br>DVR CH 1<br>MSU CONV1    | <b>SYSTEM</b><br><br><b>PRIMARY</b><br><br>DVR CH 1<br>MSU TG 1  | <b>LOCAL OR<br/>SYSTEM<br/>PRIMARY</b><br><br>DVR CH 1<br>MSU TG 1  | <b>LOCAL OR<br/>SYSTEM</b><br><br><b>SECONDARY</b><br><br>DVR CH 1<br>MSU TG 1     |

Table 14 Remote Steering Typical Scenarios

### **IMPORTANT!**

Remote change of MSU TG has no effect on the operation of the rest of the PSUs in the area when TG Proxing allowing multiple TG operation is enabled. However, if the PSU remotely steers the MSU to a conventional channel, other PSU users will loose trunking system access. Therefore Mode Steering requires special User Training to ensure safe radio communication practices.

## **Remote Steering via Call Alert Page to MSU**

Dispatcher can send a Call Alert (Page) to a specific MSU, which in turn causes DVR mode change in the following order: OFF-SYS-LOC-OFF.

It is recommended that remote mode change is disabled in the MSU and enabled in the DVR. If remote mode change is enabled in the MSU then the Call Alert Page feature must be available to the Dispatcher only. The rest of the system subscriber equipment must not have the Call Alert (Page) feature enabled since paging a specific MSU interfaced to a DVR will toggle the DVR mode and may potentially cause loss of vital communications.

If the DVR is programmed with the ID of the dispatcher console (and any other required system unit IDs) then only Pages from this specific ID / IDs will cause DVRS mode change. If "Trunking Status Send" is enabled, the DVRS will send back a mode change status to indicate its current mode (OFF, SYSTEM, LOCAL).

Only the Dispatcher Console can interpret those status messages if programmed correctly:

Status 1 = OFF mode  
Status 2 = LOCAL mode  
Status 3 = SYSTEM

Dispatcher cannot force a Non-Primary DVR to become a Primary and cannot activate a DVR when a 'VR Disabled' mode is selected on the control head.

## **Trunking System Status Indication**

If programmed, the following P25 Trunking system status indication is passed (if programmed) by the DVRS to the Local DVRS Enabled PSUs when the DVRS is in the System Mode:

- Failsoft
- Out of Range
- Site Trunking

The above status indication is not available to Generic P25 PSUs when using the DVRS. The status indication is passed to the Local PSU every time the status changes. If there is no change to the status, the DVRS send status indication to the Local PSUs at a preprogrammed time interval. The DVRS also sends a network status notification every time a Local PSU is affiliated with the System via DVRS.

## **Local Mode Indication**

When the DVRS is operating in the Local Mode, the PSU User can see "**LOCAL ONLY**" message displayed on the PSU screen if the PSU and DVR are programmed to support



it. The above indication is only available on 'DVRs Enabled' PSUs and is not available to Generic P25 PSUs when using the DVRs.

## Radio Check / Inhibit

Radio Check and Radio Inhibit functions are passed through the DVRs to the Local PSU when the DVRs is in the SYSTEM or LOCAL mode. Those functions are available to both 'DVRs Enhanced' and Generic P25 PSUs.

## P25 Trunking OTAR

P25 Over-The-Air-Rekeying (OTAR) is supported through the DVRs when the Local PSUs are of the 'DVRs Enabled' type (with required options installed), the DVRs is in the SYSTEM or LOCAL mode and the MSU is on a P25 Trunking TG.

OTAR is not supported if generic P25 PSUs are used and / or if the MSU is on a P25 Conventional channel.

## Patch

When two or three TGs are patched on the System side (using the trunking group-regrouping function), the DVRs ensures the patching is matched on the Local PSU side when 'DVRs Enabled' PSUs are used, the DVRs is in the SYSTEM or LOCAL mode and the MSU is on a P25 Trunking TG.

Patch cannot be supported on PSU TGs that are programmed for **TG Translation** in the DVR. Patch is supported only on the selected MSU TG as follows:

Inbound call from PSU on TG Translation enabled TG will be translated to the patch supergroup and repeated locally and to the system.

Outbound call will be repeated as is (with the supergroup TG ID).

## Dynamic Regrouping

The System Dispatcher can temporarily assign selected individual radios operating on different TGs to operate on a new dedicated TG. The DVRs extends this functionality to the 'DVRs Enhanced' Local PSUs when the DVRs is in the SYSTEM or LOCAL mode. Dynamic Regrouping is not supported on Generic P25 PSUs.

## Phone Interconnect

Phone Interconnect is supported on Local P25 DVRs Enhanced PSUs when the DVR is on a full duplex P25 channel (digital or mixed mode) and the MSU is on a P25 Trunking Talk Group. Phone Interconnect requires the DVR to be in the System or Local Mode.

## Adaptive Power Control

The DVRs sends P25 messages to the Local 'DVRs Enabled' PSUs to adjust their transmit power depending on the received signal strength and thereby to conserve the PSU battery. This feature is not supported on Generic P25 PSUs.

## Audio Buffering

Audio buffering is supported by the DVRs in order to eliminate loss of words / parts of words due to the inherent delays associated with acquiring system access.

## P25 Encryption

The DVRS transparently passes the P25 encryption algorithms used by the subscriber and fixed network equipment.

The DVRS can translate TG IDs (when TG Translation is enabled), however it can not translate encryption keys.

| Call From Local PSU        | DVRS / MSU Mode | Receiving Local PSU | Receiving System PSU / MSU |
|----------------------------|-----------------|---------------------|----------------------------|
| CLEAR                      | CLEAR OR SECURE | CLEAR               | CLEAR                      |
| ENCRYPTED                  | CLEAR OR SECURE | ENCRYPTED           | ENCRYPTED                  |
| Call From System PSU / MSU | DVRS / MSU Mode | Receiving Local PSU |                            |
| CLEAR                      | CLEAR OR SECURE | CLEAR               |                            |
| ENCRYPTED                  | CLEAR OR SECURE | ENCRYPTED           |                            |

Table 15 P25 Inbound & Outbound Encryption Scenarios in Digital Mode

## Automatic PSU Revert to Talk Around (TA)

The DVRS Enabled PSU (with firmware R09.00.00 or later) can be programmed to automatically revert to TA if it goes outside of the DVR radio coverage range. The PSU automatically reverts to normal full duplex operation as soon as it re-enters the DVR radio coverage range.

If using a simplex DVRS channel, the simplex PSU can be programmed to automatically revert to TA so that it can transmit even when the PSU is outside of the range of the DVRS. This way, simplex PSU-to-PSU calls will be allowed regardless of the presence or absence of the DVRS.

## Digital Outbound Takeover

When Digital Outbound Takeover is enabled in the DVR, a local PSU call is given higher priority over an ongoing outbound call as described below.

The DVR stops repeating the outbound call and starts repeating the LPSU call.

The DVR tries to key up the MSU and if channel grant is received, the inbound call is repeated to the system. Typically the MSU can only get channel grant and key up if the MSU is receiving on a different TG then the one selected on the LPSU. If the MSU is receiving a call on TG A and the LPSU tries to key up on the same TG A, the MSU will not be able to key up (Trunking System programmed for Interrupt = Never).

If TG Translation is enabled, the inbound LPSU call will always try to key up the MSU on its selected TG. The LPSU will be unable to interrupt the receiving MSU due to Interrupt Never setting on the trunking system.

The Digital Outbound Takeover operation depends on other system factors, such as DVRS programming (Call setup options on the Digital System Setup screen), trunking system programming and PSU type ('DVRS Enabled' or 'Generic P25') and its programming.

For instance, if 'Pass Deny to PSU' is enabled (checked) in the DVR, then if the LPSU receives a Deny, it will sound a deny tone, give up transmitting and will resume receiving



of the outbound call. This example assumes that the PSU is 'DVRS Enabled'. If a Generic PSU is used, the PSU will transmit even when a deny is received and the DVR will repeat locally the Generic PSU inbound call. The MSU will continue to receive the outbound call from the system and the system audio will be heard on its speaker. Digital Outbound Takeover provides the ability for Regular and Emergency PSU calls to override FNE Outbound audio, however, PSU Patch calls do not have override capabilities.

## Forced Analog Mode

Forced Analog Mode is a hybrid mode in which the communications between the DVRS and the 'DVRS Enabled' P25 PSU are digital, while the voice communications are forced to be analog when the MSU has a non-P25 Mode selected.

When a P25 Mode is selected on the MSU, the DVR operates in Digital Mode (P25 Digital voice and signaling).

### **IMPORTANT!**

**Forced Analog Mode is not supported on Generic P25 PSUs.**

## Forced Analog Mode – Summary of Features

### Forced Analog DVR Mode With Conventional Analog Mode Selected on MSU

This mode is supported on 'DVRs Enabled' PSUs ONLY.

| FEATURE  | DVR OFF Mode     | DVR SYSTEM Mode  | DVR LOCAL Mode  |
|--|------------------|--|---|
| DVRs Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>  | VR SYS <DVR CH>  | VR LOC <DVR CH>   |
| PSU Affiliation  | No               | No   | No  |
| Talk Group Proxing                                       | No               | No   | No  |
| Outbound Group Call                                      | No               | Yes  | Programmable  |
| Outbound Private Call                                    | No               | No   | No  |
| MSU Microphone PTT                                       | Keys up MSU only | Keys up both MSU and DVR. (DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No               | Yes  | Yes (Local Side)  |
| Inbound Private Call                                     | No               | No   | Yes (Local Side)  |
| Inbound Call Alert                                       | No               | No   | Yes (Local Side)  |
| Talk Permit Tones - PSU                                  | No               | Yes  | Yes   |
| Inbound Emerg. Alert                                     | Yes*             | Yes  | Yes   |
| Remote DVRs Activation & Steering                        | Yes – Call Alert | Yes – Call Alert   | Yes – Call Alert  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | NA               | NA   | NA  |
| Local Mode Indication - PSU                              | No               | No   | Yes   |
| DVR Primary / Secondary Voting                           | No               | Yes  | Yes   |
| DVR Tones – MSU Speaker                                  | No               | Yes  | Yes   |
| Radio Inhibit - PSU                                      | No               | No   | No  |
| Radio Check - PSU  | No               | No   | No  |
| P25 Trunking OTAR - PSU                                  | NA               | NA   | NA  |
| Patch  | NA               | NA   | NA  |
| Dynamic Regrouping                                       | NA               | NA   | NA  |
| Phone Interface  | No               | No   | No  |
| Adaptive Power Control - PSU                             | No               | No   | No  |
| Emerg. Alert ID Pass Through                             | No               | No   | No  |
| Audio Buffering  | No               | Yes  | Yes   |
| P25 Encryption   | No               | Programmable   | Programmable  |

\* After activation.

## Forced Analog DVR Mode With 3600 Trunking Mode Selected on MSU

This mode is supported on 'DVRs Enabled' PSUs only.

| FEATURE  | DVR OFF Mode     | DVR SYSTEM Mode  | DVR LOCAL Mode  |
|--|------------------|--|---|
| DVRs Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>  | VR SYS <DVR CH>  | VR LOC <DVR CH>   |
| PSU Affiliation  | No               | No   | No  |
| Talk Group Proxing                                       | No               | No   | No  |
| Outbound Group Call                                      | No               | Yes  | Programmable  |
| Outbound Private Call                                    | No               | No   | No  |
| MSU Microphone PTT                                       | Keys up MSU only | Keys up both MSU and DVR. (DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No               | Yes  | Yes (Local Side)  |
| Inbound Private Call                                     | No               | No   | Yes (Local Side)  |
| Inbound Call Alert                                       | No               | No   | Yes (Local Side)  |
| Talk Permit Tones - PSU                                  | No               | Yes  | Yes   |
| Inbound Emerg. Alert                                     | Yes*             | Yes  | Yes   |
| Remote DVRs Activation & Steering                        | Yes – Call Alert | Yes – Call Alert   | Yes – Call Alert  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | No               | No   | No  |
| Local Mode Indication - PSU                              | No               | No   | Yes   |
| DVR Primary / Secondary Voting                           | No               | Yes  | Yes   |
| DVR Tones – MSU Speaker                                  | No               | Yes  | Yes   |
| Radio Inhibit - PSU                                      | No               | No   | No  |
| Radio Check - PSU  | No               | No   | No  |
| P25 Trunking OTAR - PSU                                  | NA               | NA   | NA  |
| Patch  | No               | No   | No  |
| Dynamic Regrouping                                       | No               | No   | No  |
| Phone Interface  | No               | No   | No  |
| Adaptive Power Control - PSU                             | No               | No   | No  |
| Emerg. Alert ID Pass Through                             | Yes*             | Yes  | Yes   |
| Audio Buffering  | No               | Yes  | Yes   |
| P25 Encryption   | No               | No   | Programmable  |

\* After activation.

## Analog Mode

This Chapter provides details on the DVRS Analog Mode of operation.

The Analog Mode assumes the following:

- XTL™ 5000 MSU with O3 or O5 Programmed for DVRS Operation OR XTL™ 2500 MSU with M5 Programmed for DVRS Operation.
- PSU programmed for DVRS operation using a Conventional, Analog, non-ASTRO Personality.
- DVR Channel used is programmed for Analog (or Mixed) Mode of Operation.

### **NOTE:**

The basic principles of DVRS operation (both Analog and Digital) are as described in the **DVRS Operation Basics** Chapter. This Chapter focuses on features specific to the Analog Mode of operation.

### **NOTE:**

The **Local PSU** Notation throughout this Chapter refers to a Portable Subscriber Units using a Conventional Analog DVR Personality.  
The **System PSU** Notation refers to a Portable Subscriber Unit, which is programmed to communicate directly with the System Infrastructure.

## Analog Mode – Summary of Features

### Analog DVR Mode With P25 Trunking Mode Selected on MSU

The operation described below assumes a DVR Analog Mode channel and P25 Talk Group is selected on the DVR and MSU respectively.

| FEATURE  | DVR OFF Mode                    | DVR SYSTEM Mode  | DVR LOCAL Mode  |
|--|---------------------------------|--|---|
| DVRS Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>                 | VR SYS <DVR CH>  | VR LOC <DVR CH>   |
| PSU Affiliation  | No                              | No   | No  |
| Talk Group Proxing                                       | No                              | No   | No  |
| Outbound Group Call                                      | No                              | Yes  | Programmable  |
| Outbound Private Call                                    | No                              | No   | No  |
| MSU Microphone PTT                                       | Keys up MSU only                | Keys up both MSU and DVR. (DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No                              | Yes  | Yes (Local Side)  |
| Inbound Private Call                                     | No                              | No   | No  |
| Inbound Call Alert                                       | No                              | No   | No  |
| Leading / Trailing Tones - PSU                           | No                              | Yes  | Yes   |
| Inbound Emerg. Alert                                     | Yes*                            | Yes  | Yes   |
| Remote DVRS Activation                                   | Yes – DTMF                      | NA   | Yes – DTMF  |
| MSU Mode Steering  | No                              | Yes (PL/DPL)   | Yes (PL/DPL)  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | No                              | No   | No  |
| Local Mode Indication - PSU                              | No                              | No   | No  |
| DVR Primary / Secondary Voting                           | No                              | Yes  | Yes   |
| DVR Tones – MSU Speaker                                  | No                              | Yes  | Yes   |
| Radio Inhibit - PSU                                      | No                              | No   | No  |
| Radio Check - PSU  | No                              | No   | No  |
| P25 Trunking OTAR - PSU                                  | No                              | No   | No  |
| Patch  | No                              | No   | No  |
| Dynamic Regrouping                                       | No                              | No   | No  |
| Phone Interface  | No                              | No   | No  |
| Adaptive Power Control - PSU                             | No                              | No   | No  |
| Emerg. Alert ID Pass Through                             | Yes – MDC1200 with Emerg. Alert | Yes – MDC1200 with Emerg. Alert  | Yes – MDC1200 with Emerg. Alert                                 |
| Audio Buffering  | No                              | Yes  | Yes   |
| P25 Encryption   | No                              | Programmable   | Programmable  |

\* After activation.

## Analog DVR Mode With P25 Conventional Mode Selected on MSU

The operation described below assumes a DVR Analog Mode channel and Conventional P25 Channel is selected on the DVR and MSU respectively.

| FEATURE  | DVR OFF Mode                    | DVR SYSTEM Mode  | DVR LOCAL Mode  |
|--|---------------------------------|--|---|
| DVRS Status Display on the O5 / O3 / M5                  | VR OFF <DVR CH>                 | VR SYS <DVR CH>  | VR LOC <DVR CH>   |
| PSU Affiliation  | No                              | No   | No  |
| Talk Group Proxing                                       | No                              | No   | No  |
| Outbound Group Call                                      | No                              | Yes  | Programmable  |
| Outbound Private Call                                    | No                              | No   | No  |
| MSU Microphone PTT                                       | Keys up MSU only                | Keys up both MSU and DVR. (DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                       | No                              | Yes  | Yes (Local Side)  |
| Inbound Private Call                                     | No                              | No   | No  |
| Inbound Call Alert                                       | No                              | No   | No  |
| Leading / Trailing Tones - PSU                           | No                              | Yes  | Yes   |
| Inbound Emerg. Alert                                     | Yes*                            | Yes  | Yes   |
| Remote DVRS Activation                                   | Yes – DTMF                      | NA   | Yes – DTMF  |
| MSU Mode Steering  | No                              | Yes (PL/DPL)   | Yes (PL/DPL)  |
| Failsoft / Out of Range / Site Trunking Indication - PSU | NA                              | NA   | NA  |
| Local Mode Indication - PSU                              | No                              | No   | No  |
| DVR Primary / Secondary Voting                           | No                              | Yes  | Yes   |
| DVR Tones – MSU Speaker                                  | No                              | Yes  | Yes   |
| Radio Inhibit - PSU                                      | No                              | No   | No  |
| Radio Check - PSU  | No                              | No   | No  |
| P25 Trunking OTAR - PSU                                  | NA                              | NA   | NA  |
| Patch  | NA                              | NA   | NA  |
| Dynamic Regrouping                                       | No                              | No   | No  |
| Phone Interface  | No                              | No   | No  |
| Adaptive Power Control - PSU                             | No                              | No   | No  |
| Emerg. Alert ID Pass Through                             | Yes – MDC1200 with Emerg. Alert | Yes – MDC1200 with Emerg. Alert  | Yes – MDC1200 with Emerg. Alert                                 |
| Audio Buffering  | No                              | Yes  | Yes   |
| P25 Encryption   | No                              | Programmable   | Programmable  |

\* After activation.

## Analog DVR Mode With Conventional Analog Mode Selected on MSU

The operation described below assumes a DVR Analog Mode channel and Conventional Analog Channel is selected on the DVR and MSU respectively.

| FEATURE   | DVR OFF Mode     | DVR SYSTEM Mode   | DVR LOCAL Mode  |
|---|------------------|---|---|
| <b>DVRS Status Display on the O5 / O3 / M5</b>                  | VR OFF <DVR CH>  | VR SYS <DVR CH>   | VR LOC <DVR CH>   |
| <b>PSU Affiliation</b>  | No               | No  | No  |
| <b>Talk Group Proxing</b>                                       | No               | No  | No  |
| <b>Outbound Group Call</b>                                      | No               | Yes   | Programmable  |
| <b>Outbound Private Call</b>                                    | No               | No  | No  |
| <b>MSU Microphone PTT</b>                                       | Keys up MSU only | Keys up both MSU and DVR.<br>(DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| <b>Inbound Group Call</b>                                       | No               | Yes   | Yes (Local Side)  |
| <b>Inbound Private Call</b>                                     | NA               | NA  | NA  |
| <b>Inbound Call Alert</b>                                       | No               | No  | No  |
| <b>Leading / Trailing Tones - PSU</b>                           | No               | Yes   | Yes   |
| <b>Inbound Emergency Alert</b>                                  | Yes*             | Yes   | Yes   |
| <b>Remote DVRS Activation</b>                                   | Yes – DTMF       | NA  | Yes – DTMF  |
| <b>MSU Mode Steering</b>  | No               | Yes (PL/DPL)  | Yes (PL/DPL)  |
| <b>Failsoft / Out of Range / Site Trunking Indication - PSU</b> | NA               | NA  | NA  |
| <b>Local Mode Indication - PSU</b>                              | No               | No  | No  |
| <b>DVR Primary / Secondary Voting</b>                           | Yes              | Yes   | Yes   |
| <b>DVR Tones – MSU Speaker</b>                                  | No               | Yes   | Yes   |
| <b>Radio Inhibit - PSU</b>                                      | No               | No  | No  |
| <b>Radio Check - PSU</b>  | No               | No  | No  |
| <b>P25 Trunking OTAR - PSU</b>                                  | NA               | NA  | NA  |
| <b>Patch</b>  | NA               | NA  | NA  |
| <b>Dynamic Regrouping</b>                                       | NA               | NA  | NA  |
| <b>Phone Interface</b>  | NA               | NA  | NA  |
| <b>Adaptive Power Control - PSU</b>                             | NA               | NA  | NA  |
| <b>Emerg. Alert ID Pass Through</b>                             | No               | No  | No  |
| <b>Audio Buffering</b>  | No               | Yes   | Yes   |
| <b>P25 Encryption</b>   | No               | Programmable  | Programmable  |

\* After activation.



## Analog DVR Mode With 3600 Analog or Digital Trunking Mode Selected on MSU

The operation described below assumes a DVR Analog Mode channel and 3600 Analog or Digital Trunking Mode is selected on the DVR and MSU respectively.

| FEATURE   | DVR OFF Mode                    | DVR SYSTEM Mode   | DVR LOCAL Mode  |
|---|---------------------------------|---|---|
| DVRS Status Display on the O5 / O3 / M5               | VR OFF <DVR CH>                 | VR SYS <DVR CH>   | VR LOC <DVR CH>   |
| PSU Affiliation                                       | No                              | No  | No  |
| Talk Group Proxing                                    | No                              | No  | No  |
| Outbound Group Call                                   | No                              | Yes   | Programmable  |
| Outbound Private Call                                 | No                              | No  | No  |
| MSU Microphone PTT                                    | Keys up MSU only                | Keys up both MSU and DVR.<br>(DVR may be programmed not to transmit Mic Audio.) | Keys up DVR only or both DVR & MSU depending on MSU programming |
| Inbound Group Call                                    | No                              | Yes   | Yes (Local Side)  |
| Inbound Private Call                                  | No                              | No  | No  |
| Inbound Call Alert                                    | No                              | No  | No  |
| Leading / Trailing Tones - PSU                        | No                              | Yes   | Yes   |
| Inbound Emergency Alert                               | Yes*                            | Yes   | Yes   |
| Remote DVRS Activation                                | Yes – DTMF                      | NA  | Yes – DTMF  |
| MSU Mode Steering                                     | No                              | Yes (PL/DPL)  | Yes (PL/DPL)  |
| Failsoft / Out of Range / Site Trunk Indication - PSU | No                              | No  | No  |
| Local Mode Indication - PSU                           | No                              | No  | No  |
| DVR Primary / Secondary Voting                        | No                              | Yes   | Yes   |
| DVR Tones – MSU Speaker                               | No                              | Yes   | Yes   |
| Radio Inhibit - PSU                                   | No                              | No  | No  |
| Radio Check - PSU                                     | No                              | No  | No  |
| P25 Trunking OTAR - PSU                               | NA                              | NA  | NA  |
| Patch   | No                              | No  | No  |
| Dynamic Regrouping                                    | No                              | No  | No  |
| Phone Interface                                       | No                              | No  | No  |
| Adaptive Power Control - PSU                          | No                              | No  | No  |
| Emerg. Alert ID Pass Through                          | Yes – MDC1200 with Emerg. Alert | Yes – MDC1200 with Emerg. Alert   | Yes – MDC1200 with Emerg. Alert                                 |
| Audio Buffering                                       | No                              | Yes   | Yes   |
| P25 Encryption  | No                              | No  | Programmable  |

\*After activation.

## Inbound Call

When a Local PSU User switches to the selected DVR Analog Channel, he / she can communicate with:

- Other PSU users which have the same DVR Analog channel selected on their radios and which are within the radio coverage range of the active Primary DVR.
- System Users of the TG currently selected on the Control Head of the MSU interfaced to the Primary DVR.

### **NOTE:**

If the selected DVR TG / channel attribute is programmed as a Simplex or Half-Duplex the local audio repeat function is not available.

## Outbound Call

Calls received by the MSU on the selected TG / Channel are repeated to the Local PSU Users over the selected DVR Channel.

If the MSU receives an Encrypted Call, the DVR can be programmed to do one of the following:

- Repeat the Encrypted Call to the Local Analog PSU
- Send Beeps to the Local PSU
- Repeat Clear Audio to the Local PSU if MSU is equipped to decrypt the audio.

## MSU Mic PTT

When the MIC PTT is activated and the DVR is in the SYSTEM Mode, the DVR may be programmed to either transmit the MIC audio to the system (by MSU) and locally (by DVR) OR only to the system (by MSU).

In the LOCAL Mode, Microphone PTT keys up the DVR and may be programmed to key up the MSU as well.

### **NOTE:**

Microphone PTT has higher priority over DVR repeat.

## Leading & Trailing Tones

The DVR can be programmed to send over-the-air Leading or Trailing tones to the LPSUs to indicate successful MSU key up / system access.

If Leading Tones are enabled, the LPSU operation involves the following:

1. User does a quick PTT of LPSU so that MSU can request channel grant
2. User releases the PTT for a moment and waits to hear the Leading tones.
3. If the Leading tones indicate successful system access (channel grant), the LPSU user PTTs again and talks.
4. If the Leading tones indicate lack of channel grant, the LPSU user can try the call again.

Trailing tones are sent at the end of LPSU transmission and therefore do not require double PTT.

Both Leading and Trailing Tones are sent over-the-air (i.e. not generated in the PSU that initiates the call) therefore all LPSUs that are within the DVR range and switch to the DVR channel will hear the tones.

## Portable Priority Interrupt (PPI)

When PPI is enabled (analog SIMPLEX DVR channels only), base-to-portable outbound calls are periodically interrupted so the DVR can search for a LPSU transmission and give the LPSU transmission higher priority over the system outbound call. This interruption may be heard on the LPSU as a 'clicking' noise.

If an LPSU signal without valid PL tone is present when the DVR is interrupted, the DVR Transmitter remains inhibited for the duration of the incoming signal.

If the LPSU signal has valid PL, the Priority DVR repeats the LPSU call to the base station on top of the incoming signal i.e. the MSU is keyed up even though it is still receiving from the base. Trunking System may not allow the receiving MSU to key up.

## Emergency in Analog Mode

The Emergency operation in Analog Mode is based on the type of signaling as selected in the Emergency Mode Setup Menu. The recommended Analog Mode signaling type is MDC1200. Note that in addition to the DVR programming, MDC1200 signaling must also be enabled in the Local PSU personality.

When the Local Analog PSU User presses the Emergency button and the PSU sends an Emergency Alarm, the DVR decodes the Emergency Alarm and passes it to the System. The DVR sends ACK tones / signaling back to the Local PSUs either after receiving Console ACK, Site (FNE) ACK or right after decoding the Emergency from the PSU depending on the DVR programming.

When the PSU User presses the PTT, he / she enters the Emergency Call state if the PSU is programmed for Emergency Call and Alarm.

On Trunking Systems the Dispatch Console will receive the PSU Emergency ID with the Emergency Alarm, followed by the MSU ID if the MSU is programmed to enter emergency when the DVR receives a Local PSU emergency. In order to be able to process Emergency Call from the PSU, the MSU must also have the Emergency Call enabled and the DVR needs to be programmed to put the MSU in emergency upon detection of PSU emergency.

### **NOTE:**

PSU Emergency MDC1200 ID is displayed in hexadecimal format on the PSU / MSU display, however the same ID is displayed in decimal format on the Dispatcher Console.

If the DVRS is in the OFF mode when the Local PSU sends the Emergency Alarm, the DVRS will switch to the System Mode and process the Emergency after the Emergency Attempts Counter expires and the Emergency Alarm is not processed by another Primary DVR.

The DVR may be programmed to display the Local PSU Emergency MDC1200 ID on the Control Head display of the Primary DVRS (which processed the Emergency to the System). To clear the ID from the Display, the VRS button / softkey needs to be pressed momentarily.

When MDC 1200 signaling is used, the Local PSU Emergency Alarm MDC ID will be passed through to the System only if the MDC ID is enabled (valid) on the System side.

**IMPORTANT!**

**MDC PTT ID pass through is not supported by the DVRS.**

## **Audio Buffering**

Audio buffering is supported by the DVRS in order to eliminate loss of messages / parts of messages due to the inherent delays associated with acquiring system access.

## **Remote DVRS Activation via DTMF**

The Local PSU may be programmed to remotely activate the DVR by switching it from OFF or LOCAL to SYSTEM mode by sending a pre-programmed DTMF sequence.

The remote activation only works if the Local PSU and the DVR are set to operate on the same radio channel.

The DVR cannot be switched OFF remotely via DTMF.

## **Remote MSU Mode Steering via LPSU PL/DPL**

The LPSU & DVR may be programmed so that when the LPSU transmit specific PL/DPL, the DVR steers the MSU to a programmed MSU Mode. The DVR needs to be programmed with a lookup table mapping the LPSU PL/DPL codes with their corresponding MSU modes / channels.

When the DVR decodes the PL/DPL it finds the corresponding MSU mode in its look-up table and steers the MSU to the new mode. Depending on the programming, the MSU may either stay on the new mode or it may revert after a preprogrammed timer expires to the originally selected MSU mode.

The preprogrammed timer starts after the LPSU causing the steering keys off.

**This feature is only supported in SYSTEM Mode.**

## **Steering and Emergency**

If steering is disabled on the current DVR channel, LPSU emergency is declared on the currently selected MSU channel (no steering).

If steering is enabled on the current DVR channel, the LPSU emergency is declared on the new (steered) MSU mode.

## P25 Encryption in Analog Mode

If the MSU is receiving a P25 Encrypted Outbound call while the DVRS is operating on an Analog Channel, the DVRS can be programmed to do one of the following:

- Repeat the Encrypted Call to the Local Analog PSU
- Send Beeps to the Local PSU
- Repeat Clear Audio to the Local PSU if MSU is equipped to decrypt the audio.

The handling of Encrypted Inbound Calls by the DVRS depend on the DVR programming for handling of Outbound Encrypted Calls as shown in the Table below:

| Call from Local PSU | MSU Mode        | DVR Programmed Outbound Encrypted Calls | Receiving Local PSUs            | Receiving System PSU / MSU      |
|---------------------|-----------------|---|---------------------------------|---------------------------------|
| ENCRYPTED           | Clear or Secure | Transmit Encrypted                      | ENCRYPTED                       | ENCRYPTED                       |
| ENCRYPTED           | Clear or Secure | Transmit Clear                          | Inbound Call is ignored by DVRS | Inbound Call is ignored by DVRS |
| ENCRYPTED           | Clear or Secure | Send Warning Tones                      | Inbound Call is ignored by DVRS | Inbound Call is ignored by DVRS |

**Table 16 Handling of Inbound Encrypted Calls on Analog DVR Channel**

## Mixed Mode

Mixed DVR mode allows Analog DVR operation by switching between Digital and Analog modes as described below.

The use of Mixed mode for Analog DVRS communications is not recommended since it requires special User Training. Mixed DVR mode should only be used when both analog and digital PSUs are required to operate on the same DVR channel.

Mixed DVRS Mode requires the MSU to be switched to a P25 Digital channel.

When a DVR Channel is programmed to operate in Mixed Mode, the DVRS can handle calls from both P25 and Analog Local PSUs while the same DVR channel is selected on the O5 / O3 / M5.

When Mixed Mode is selected, the DVR can be toggled between Digital and Analog Mode as follows.

The default DVRS mode is Digital i.e. the P25 modem is enabled by default. If a Call from a Local PSU is detected and the DVR does not decode a P25 Frame sync within the preprogrammed '**P25 Frame Sync Detection Timer**', the DVR switches to Analog Mode and starts decoding Analog Mode signaling (such as DTMF, MDC1200). The DVR repeats Analog signals to the Local Analog PSUs and System MSUs / PSUs on the selected System channel / TG. After the Local PSU keys off, the DVR stays in the Analog Mode for the duration of the preprogrammed '**VR Ch Mixed Mode Hold Timer**'. Any Outbound calls which are received by the MSU prior to the above timer's expiration will be repeated by the DVR as Analog Conventional. Once the '**VR Ch Mixed Mode Hold Timer**' expires, the DVR returns back to Digital Mode and any Outbound calls are repeated as digital.

Inbound analog calls received by the DVR in Mixed Mode are repeated to the System by the MSU on the selected TG / Channel.

If TG Proxing is enabled, digital Inbound calls received by the DVR are transmitted by the MSU on the TG selected on the Local PSU (not on the TG selected on the MSU).

## Special Features Support

### Fireground Signaling

The DVR can be programmed to repeat locally (when used in the Full-Duplex mode) Fireground Signaling sent by the Local PSUs to a Fireground terminal located within the DVR range at the same incident scene. Fireground signaling support can be enabled (by DVR programming) on either Analog or Digital DVR channels and requires the use of Fireground-enabled Local PSUs. In addition, the DVR may be programmed to repeat Fireground Emergency Signaling only locally or / and to forward Fireground Emergency received from a Local PSU to the System.

### TPS Signaling

TPS Signaling support can be enabled on a DVR channel, operating in conjunction with a Conventional P25, Trunking P25 or Conventional Analog Mobile Radio channel. This option enables specially programmed Local PSUs to transmit TPS Leading and / or Trailing IDs. TPS Emergency can also be received and processed by the DVRS when on the corresponding TPS Enabled Analog channel.



## Troubleshooting

If the Control Head displays alternating **VR ERROR** and Error Code (RC ERROR XXXX or RF ERROR XXXX), turn the DVRS off and then back on. If it does not correct the condition, contact Futurecom to obtain an RMA.

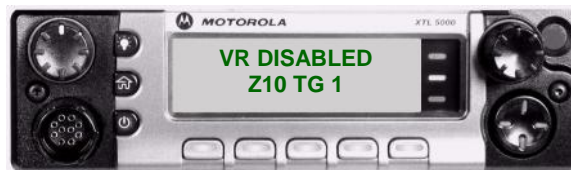
“MAINTENANCE MODE REMOTE DEVICE” on the control head may indicate that the Mobile Radio Control Head needs to be flash upgraded or that the XTL5000 transceiver is not powered up.

“INCOMPATIBLE MSU SW” displayed on the control head indicates that the MSU needs to be flash upgraded to match the firmware currently loaded in the DVR.



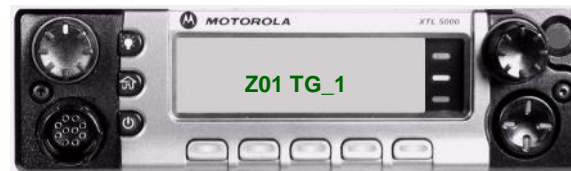
**NORMAL DISPLAY, DVR ACTIVE:**

VR SYS [CHAN NAME]  
VR LOC [CHAN NAME]  
VR OFF [CHAN NAME] (NO DVR ICON)



**NORMAL DISPLAY - DVR DISABLED BY PROGRAMMING**

MOBILE MODE SELECTED IS NOT DVR ENABLED



**DVR NOT DETECTED**

**POSSIBLE CAUSES:**  
DVR NOT POWERED  
CABLE FAULT  
DVR FAILURE

If DVRS operation is intermittent, check with other DVRS users for similar problems and try using different PSU and / or channel before contacting a qualified radio technician. Similar problems indicate a system malfunction or programming issues rather than a radio failure.

'Warning' 'RC0400' flashing 4 times on Power Up indicates Primary EEPROM Map corrupted. The unit is fully operation (working from the backup EEPROM map), however it requires to be serviced. Please bring the unit to your authorized radio shop for service. Reading the unit with the latest Tweaker version will restore the Primary map from the backup.



## Appendix 1 – DVR Specifications

| General Specifications               |  |                               |               |               |
|--------------------------------------|--|-------------------------------|---------------|---------------|
| Dimensions: Height / Width / Depth   | 185mm (7.28") / 186mm (7.32") / 315mm (12.41")                             |                               |               |               |
| Weight                               | 10.3kg (22.7lb)  |                               |               |               |
| Channel Spacing                      | 12.5 or 25 kHz programmable  |                               |               |               |
| Number of Channels                   | 192  |                               |               |               |
| CTCSS/DCS                            | Programmable per Channel   |                               |               |               |
| Power Supply                         | 13.8V DC +/- 20%   |                               |               |               |
| DC Current Drain                     |  |                               |               |               |
| RPTR Off                             | 0.01 A Max   |                               |               |               |
| Standby/Receive                      | 0.8 A Max  |                               |               |               |
| Transmit                             | 4.5 A Max  |                               |               |               |
| Operating Temperature                | -30°C to +60°C   |                               |               |               |
| Protection Against Liquids           | IP6 (water jet proof)  |                               |               |               |
| Antenna Impedance                    | 50 Ohms  |                               |               |               |
| External Connectors                  |  |                               |               |               |
| Antenna                              | Mini UHF   |                               |               |               |
| Computer Interface                   | USB  |                               |               |               |
| Equipment Type Acceptance            | VHF  | UHF                           | 700           | 800           |
| FCC                                  | LO6-DVRSVHF  | LO6-DVRSUHF                   | LO6-DVRS700   | LO6-DVRS800   |
| Industry Canada                      | 2098B-DVRSVHF  | 2098B-DVRSUHF                 | 2098B-DVRS700 | 2098B-DVRS800 |
| Transmitter Specification            | VHF  | UHF                           | 700           | 800           |
| Frequency Band [MHz]                 | 136-174  | 380-430<br>450-470<br>470-512 | 764-776       | 851-870       |
| Power Output @ Antenna Port          | 10W (programmable per channel from 1W to 10W)                              |                               |               |               |
| TCT Option                           | 15 sec to 15 min or Disabled   |                               |               |               |
| Max Spurious Output                  | -60dBc   |                               |               |               |
| Frequency Stability                  | +/- 1.5ppm   |                               |               |               |
| FM Hum and Noise 12.5 / 25 kHz       | 37 dB / 43 dB  |                               |               |               |
| Audio Response                       | +1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz |                               |               |               |
| Audio Distortion                     | <2%  |                               |               |               |
| Receiver Specification               | VHF  | UHF                           | 700           | 800           |
| Frequency Band [MHz]                 | 136-174  | 380-430<br>450-470<br>470-512 | 794-806       | 806-825       |
| Receiver Sensitivity                 | -115 dBm   |                               |               |               |
| Frequency Stability                  | +/- 1.5ppm   |                               |               |               |
| Selectivity 12.5 / 25 kHz            | 60 dB / 75 dB  |                               |               |               |
| Intermodulation                      | 70 dB  |                               |               |               |
| Deviation 12.5 / 25 kHz              | +/-2.5 kHz / +/-5 kHz  |                               |               |               |
| FM Hum and Noise 12.5 / 25 kHz       | 37 dB / 43 dB  |                               |               |               |
| Audio Output (Repeater Detect Audio) | 600 mV RMS nominal, flat response  |                               |               |               |
| Audio Response                       | +1, -3 dB of 6 dB / octave pre-emphasis characteristic over 300 Hz – 3 kHz |                               |               |               |
| Audio Distortion                     | <2%  |                               |               |               |

## Contact Information

### Technical Support

905-660-5548  
support@futurecom.com

### Orders

Please contact Motorola / Drop Ship

### Return Authorizations

1-800-701-9180

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[www.futurecom.com](http://www.futurecom.com)

## Glossary

|                          |  |
|--------------------------|--|
| <b>ACK</b>               | Acknowledgement of communications.   |
| <b>AVRA</b>              | Automated VR / DVR Activation. DVR Option which permits automated activation of the DVR, typically triggered by removing the portable from the charger (ON) and placing it back in (OFF).  |
| <b>Channel</b>           | A group of characteristics, such as transmit / receive frequency pairs, radio parameters, encryption encoding etc.   |
| <b>Coded Squelch</b>     | Tone Private-Line (PL) or Digital Private-Line (DPL). Used on conventional channels for signal validation.   |
| <b>Conventional</b>      | Refers to radio-to-radio communications, sometimes through a base station repeater or vehicular repeater.  |
| <b>Dispatcher</b>        | An individual who has radio system management duties.  |
| <b>DPL Coded Squelch</b> | A continuous sub-audible data signal transmitted with the carrier. See Coded Squelch.  |
| <b>DVR</b>               | Digital Vehicular Repeater.  |
| <b>DVR Mode</b>          | Determines the communication exchange capabilities between System Users and Local Portable Users; Can be set to OFF, LOCAL or SYSTEM.  |
| <b>DVRS</b>              | Digital Vehicular Repeater interfaced to a Remote Mount XTL™5000 Mobile radio with O3/O5 Control Head or Remote Mount XTL™2500 Mobile radio with M5 Control Head, including all filtering and cables / antennas.                               |
| <b>DVRS Enabled PSU</b>  | P25 XTS™1500, XTS™2500, XTS™5000, APX™4000, APX™6000 or APX™7000 Portable Radio with enabled DVRS operation.   |
| <b>DVR ID</b>            | Programmable (in the DVR) ID, which is used for Mode / TG steering. To remotely change the Mode / TG on the DVRS, the PSU User sends a Call Alert (Page) to the specific DVR ID.   |
| <b>FCC</b>               | Federal Communications Commission.   |
| <b>Half Duplex</b>       | DVR Mode, programmable per TG / DVR Channel. While in Half Duplex Mode the DVR repeats Local PSU-to-System and System-to-Local PSU communications but does not repeat audio locally i.e. no Local PSU-to-PSU voice communications are enabled. |
| <b>HUB</b>               | Hang Up Box – if this feature is enabled in the DVR and the microphone is off hook, any audio received from the Local PSUs, regardless of the TG will be heard on the MSU speaker Applicable to Digital DVR Mode with Proxing Enabled ONLY!    |

|                      |   |
|----------------------|---|
| <b>Inbound Call</b>  | A call transmitted by Local PSU and received by the DVR.  |
| <b>Local Mode</b>    | DVR Mode which provides extended portable-to-portable voice and data range by repeating Local PSU (optionally MSU) communications without keying up the Mobile radio interfaced to the DVR.                                   |
| <b>M5</b>            | XTL™2500 Control Head using CAN bus.  |
| <b>Mobexcom II</b>   | Analog Vehicular Repeater, NOT compatible with XTL™5000 radios using CAN bus Control Heads such as the O3/O5. Mobexcom II can be interfaced to XTL™5000 using W-series Control Heads, Astro Spectra or MCS2000 Mobile Radios. |
| <b>Mode</b>          | MSU / PSU Mode - A programmed combination of operating parameters.<br>DVR Mode – OFF, SYSTEM or LOCAL (see <b>DVR Mode</b> )  |
| <b>MPE</b>           | Maximum Permissible Exposure.   |
| <b>MSU</b>           | Mobile Subscriber Unit - XTL™2500 or XTL™5000.  |
| <b>Outbound Call</b> | System Call received by the MSU.  |
| <b>O3/O5</b>         | XTL™5000 Odyssey 3 or 5 Control Head using CAN bus.   |
| <b>PSU</b>           | Portable Subscriber Unit.   |
| <b>PTT</b>           | Push to talk. The PTT engages the transmitter (of the Portable or Mobile radio and / or DVR) when pressed.  |
| <b>RF</b>            | Radio Frequency. Part of the general frequency spectrum 10kHz - 10,000,000 MHz.   |
| <b>RSSI</b>          | Received Signal Strength Indicator.   |
| <b>System Mode</b>   | DVR mode which provides extended voice and signaling communications between System Users and Local Portable Users over the selected DVR channel / Mobile Radio Mode.  |
| <b>Talk Group</b>    | A group of radio users who communicate with each other by using the same communication path.  |
| <b>Trunking</b>      | The automatic sharing of radio frequencies by large number of users based on communication path sharing for the length of a conversation.   |

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