Tuning Guide

How to Tune Comfort Intercom/Recording System

INTRODUCTION

This Tuning Guide attempts to assist in the adjustment of system parameters to obtain better intercom performance between the various intercom devices. In this document, four different intercom modes are discussed, namely:

1. Door Station <--> Keypad
2. Local Phone <--> Keypad / Door Station
3. Remote Phone <--> Keypad / Door Station
4. Remote Phone <--> Keypad / Door Station (via UCM/GSM)

There are both hardware and software adjustments that can be made. The hardware adjustments deal with the adjustments of trimmer levels on the devices and/or the main control panel itself. The software adjustments are made in the Tuning Parameters in Comfort or in the Locations menu

PRINCIPLE OF OPERATION
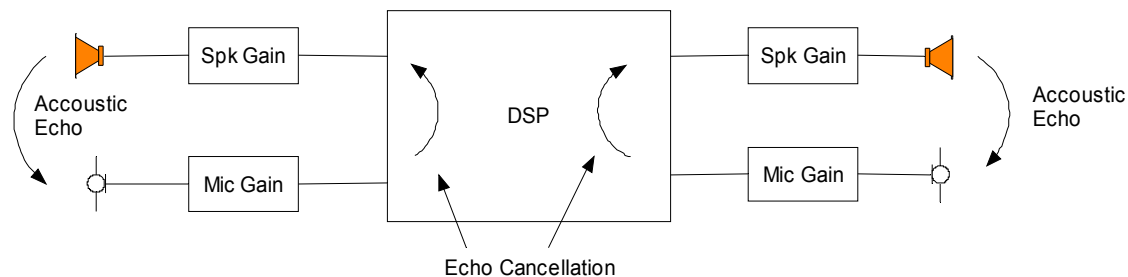
The above block diagram shows the operation of the full duplex Intercom system. For Telephone to Keypad/Door station, the left represents the telephone handset, and the right represents the Keypad or Door Station. For keypad to Door station Intercom, the left represents the keypad and the right represents the Door station.

The purpose of the tuning is to prevent "howling" which results from excessive acoustic feedback in the system. This occurs on both sides due to acoustic echo where the sound from the speaker is picked up by the microphone of the keypad/microphone. In the keypad and Door stations, sponges are mounted within the enclosure to improve acoustic isolation. The older KP01 and DP01 are not suited for full duplex intercom because the speaker is larger and more powerful and it is more difficult to cancel the echo within the enclosure.

Within Comfort, a Digital Signal Processor (DSP) attempts to cancel the echoes which are picked up by each microphone using complex algorithms. In doing so the volume of the speech may be reduced to minimise the echo and prevent howling. This is why when the system has not been tuned the sound from one of the speakers may be inaudible. When the DSP is unable to reduce the echo sufficiently, howling will result.

Tuning consists of adjustment of the trimmers for microphone and speaker on each side and the Tuning Parameters which set the gain of the microphone and speaker blocks. Comfigurator 2.1 does not have a means to change Tuning parameters. Until the new version of Comfigurator is released use the Locations menu (Engineer Menu 7,4,1) to change the location values mentioned.

HARDWARE ADJUSTMENTS

The trimmers that can be adjusted to change the various gains are as follow:

Device	Trimmer	Description
Keypad (KP03 /04)	VR1	Determines the speaker signal level to the keypad. This affects the intercom level. Normally set to centre.
Door Station (DP03)	VR1A	Determines the speaker signal level to the door station. This affects the intercom level. Normally set to centre.
Door Station Interface (DM01)	MIC (VR1)	Determines the microphone signal level from external intercom. This affects the external intercom recording level and intercom level. Normally set to centre.
	VOICE (VR2)	Determines the speaker signal level to external intercom. This affects the intercom level. Normally set to centre.
Main Control Panel	KPMIC (VR51)	Determines microphone signal level from keypads. This affects keypad recording level and intercom level. Normally set to centre. Tune clockwise to increase microphone signal level.
	DPMIC (VR53)	Determines microphone signal level from door station. This affects keypad recording level and intercom level. Normally set to centre. Tune clockwise to increase microphone signal level.

The keypad and Door station microphones each have a trimmer which combines with the software Mic Gain to give the total Mic Gain. However, the trimmer will affect the Record gain when recording a message via the KP/DP as well as the intercom mic gain

The keypad and door stations have their own volume adjustment which combines with the software speaker gain to give the total speaker gain. However the hardware volume control will also affect the keypad voice menu volume and announcements on the KP/DP

These trimmers should be the first adjustment to be made to the system before attempting to modify the system parameters if they are already set to the default values

The strategy is to first set the Keypad and Door station Microphone trimmers to a minimum level which is able to hear the voice from the other end, while leaving the Tuning parameters at the default levels. Excessive microphone gain will result in higher levels of acoustic echo which will in turn reduce volume of the speaker or cause howling if the acoustic echo cannot be cancelled.
The Door Station volume (Internal Trimmer) set at a minimum level which is able to hear the voice from the other end. For the keypad, set the volume around the middle. Note that the voice menu volume on the keypad can be set independently in Voice Settings > Keypad Voice level.

The following sections will guide you to adjust the settings to achieve an acceptable volume for both sides on the intercom. To do this you need TWO people, one on each side of the intercom i.e. one on the mobile or local phone and the other person at the keypad or Door station

REMOTE PHONE – KEYPAD / DOOR STATION INTERCOM

Remote Phone   Intercom   Door Station
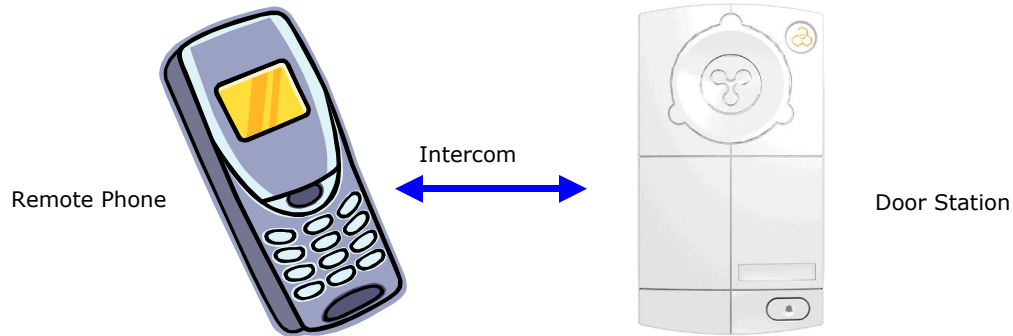
The Performance of Remote phone to KP/DP intercom will be more difficult to adjust compared to Local Phone Intercom to KP/DP, due to the longer delays associated with the telephone network, especially for Mobile phones. It is best to use the mobile phone which will be most likely used in intercom mode to do the adjustments, and test with other mobile phones.

For the Remote Phone to Keypad / Door Station intercom tuning, the following parameters affect the performance:
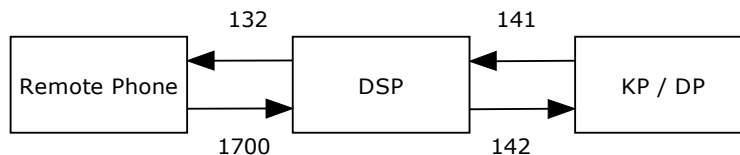
- **Location 1700**, which adjusts the gain of the microphone for the Remote Phone during Remote Phone-KP / DP intercom mode. **Voice Settings > Phone Intercom Voice Level can be used to change this parameter.**
- **Location 132**, which adjusts the gain of the voice to Remote Phone. **Note that this applies to the voice menu volume on remote telephone, and not just in intercom mode**. **Note that Voice Settings > Phone Voice Level (Location 1706) has a similar effect but on both local and remote phones**
- **Location 141**, which adjusts the gain of the microphone for the KP / DP during Remote Phone-KP / DP intercom mode
- **Location 142**, which adjusts the gain of the speaker for the KP / DP during Remote Phone-KP / DP intercom mode

The default values are as follow:

Parameter	Phone Intercom Voice level	Voice Level to Remote Phone Intercom	KP/DP Intercom Mic Gain	KP/DP Intercom Speaker Gain
CF Index	-	76	85	86
Location	1700*	132	141	142
Default Value	10	2	7	0
Min	0 (low)	0 (high)	0 (low)	0 (high)
Max	20 (high)	4 (low)	20 (high)	4 (low)
Direction	Increase gain	Decrease gain	Increase Gain	Decrease Gain

- Voice Settings > Phone Intercom Voice Level can be used instead of Location 1700
- The applicability of the default settings also depends on the tuning of the trimmers
- CF Index refers to the index in the Tuning Parameters Screen in Comfigurator
- Location is the Location number accessed in Engineer menu 7,4,1
- "Direction" tells if increasing the value of the parameter will increase or decrease the gain. For example, in Location 86, if the value is increased from 0 to 1, the Gain of the KP speaker will be reduced.

A simplified block diagram is shown below:

```
            132              141
        ┌──────────┐     ┌──────────┐     ┌──────────┐
        │  Remote  │ ◄── │   DSP    │ ◄── │  KP / DP │
        │  Phone   │ ──► │          │ ──► │          │
        └──────────┘     └──────────┘     └──────────┘
            1700             142
```

To begin, check that the locations above have the default values programmed, as it may be different previous defaults supplied with Comfigurator. Change these locations to the defaults and RESET the system. When you change a set of location values, RESET the system before testing the effect

Howling at KP/DP or Phone

If you hear howling (positive feedback) on either side or the values in the above locations are already at default, then adjust the appropriate microphone trimmer (VR51 for KP and VR53 for DP) on Comfort Main board. The KP or DP volume controls should be set at a suitable volume for voice menu and not at maximum.

Varying Voice Level on KP/DP

One of the most common problems encountered when doing a remote Intercom to Voice Station (Keypad) or Door Station, the voice heard on the keypad/door station is intermittently loud then soft when talking on the telephone.
This is caused by feedback from the keypad/Door Station speaker to its own microphone. Comfort tries to compensate by reducing the speaker volume when the microphone picks up too much echo.
The remedy for this is to reduce the MIC gain using the trimmer VR51 (KP) or VR53 (DP) on the Comfort main board. Turn anticlockwise to reduce gain. This would allow stable volume on both ends.
The setting of the trimmer depends on telephone line conditions depending on the location of the house so the factory default adjustment may not be optimum

However, check that the MIC trimmer level allows adequate volume when recording a message on the keypad using F4. If the recorded message is too soft, use Location 107 (see below) to increase the Mic Gain for Recording (which does not affect the Intercom)

KP/DP cannot be heard on Mobile Phone

Sometimes, local phone to KP/DP intercom is clear in both directions but the mobile phone cannot hear voice on the KP/DP while mobile phone to KP/DP voice is clear

This indicates that the path from Mic to mobile phone handset speaker gain is too small compared to that from phone mic to KP/DP speaker. If there is no howling it means that the full duplex system has stabilised but at the expense of one side of the conversation.

If the KP/DP Mic to phone speaker volume is high, then reduce 1700 (phone Mic Gain) by 1 or more steps, until the voice heard on the KP/DP is softer but still audible. This change alone may improve the volume heard on the phone
If the volume of voice heard on the phone is still too soft, try increasing the gain of remote phone speaker by **reducing** the value in Location 132 (min is 0), unless it is already at 0. If Location 132 is already (max gain) then increase the gain of KP/DP by adjusting the MIC trimmer clockwise to increase gain.

The best possible performance for the full duplex intercom is obtained if the microphone is physically removed from the KP/DP enclosure. Even opening the enclosure will show a marked improvement in volume. If it is possible in the site, removing the microphone and mounting it elsewhere, e.g. behind or above the KP/DP will improve performance.

LOCAL PHONE – KEYPAD / DOOR STATION INTERCOM

Local Phone   Intercom   Keypad
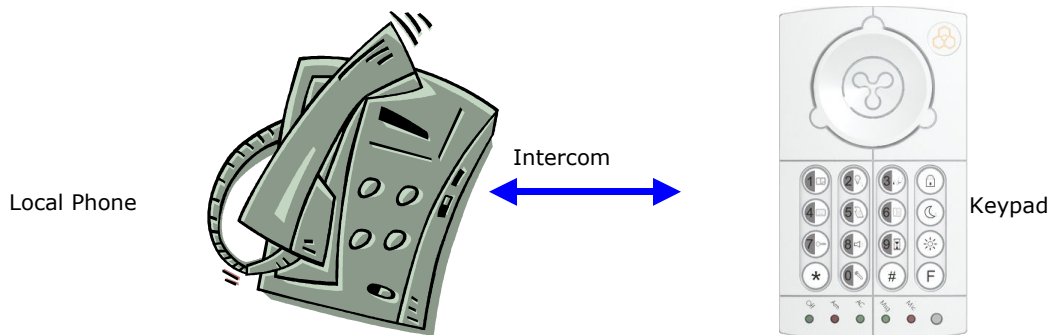
For the Local Phone to Keypad / Door Station intercom tuning, the following parameters affect the performance:
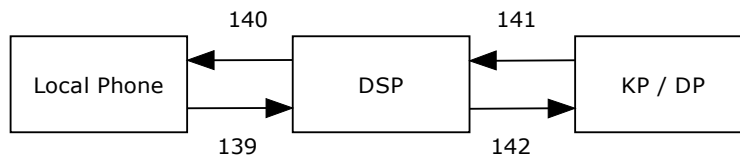
- **Location 139**, which adjusts the gain of the microphone for the Local Phone during Local Phone-KP / DP intercom mode
- **Location 140**, which adjusts the gain of the speaker for the Local Phone during Local Phone-KP / DP intercom mode
- **Location 141**, which adjusts the gain of the microphone for the KP / DP during Phone-KP / DP intercom mode
- **Location 142**, which adjusts the gain of the speaker for the KP / DP during Phone-KP / DP intercom mode

The default values are as follow:

| Parameter	Local Phone Intercom Mic Gain	Local Phone Intercom Spk Gain	KP/DP Intercom Mic Gain	KP/DP Intercom Speaker Gain
CF Index	83	84	85	86
Location	139	140	141	142
Default Value	6	4	7	0
Min	0 (low)	0 (high)	0 (low)	0 (high)
Max	20 (high)	4 (low)	20 (high)	4 (low)
Direction	Increase gain	Decrease gain	Increase Gain	Decrease Gain

- CF Index refers to the index in the Tuning Parameters Screen in Comfigurator
- Location is the Location number accessed in Engineer menu 7,4,1
- "Direction" tells if increasing the value of the parameter will increase or decrease the gain. For example, in Location 86, if the value is increased from 0 to 1, the Gain of the KP speaker will be reduced.

A simplified block diagram is shown below:

```
            140                    141
  ┌──────────────┐ ◄───── ┌──────────┐ ◄───── ┌──────────┐
  │  Local Phone │        │   DSP    │         │  KP / DP │
  └──────────────┘ ─────► └──────────┘ ─────►  └──────────┘
            139                    142
```

Locations 141 and 142 have already been adjusted in the previous section dealing with remote phone intercom, so it should be left alone here. Location 139 and 140 should be adjusted if needed, although it is likely that the performance of local phone intercom would be superior to mobile phone intercom
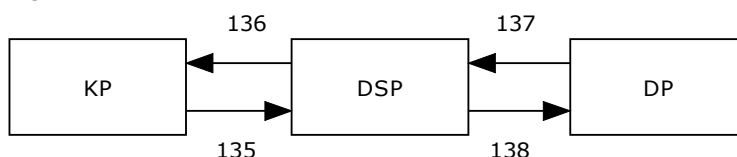
DOOR STATION – KEYPAD INTERCOM TUNING PARAMETERS

Door Station   Intercom   Keypad
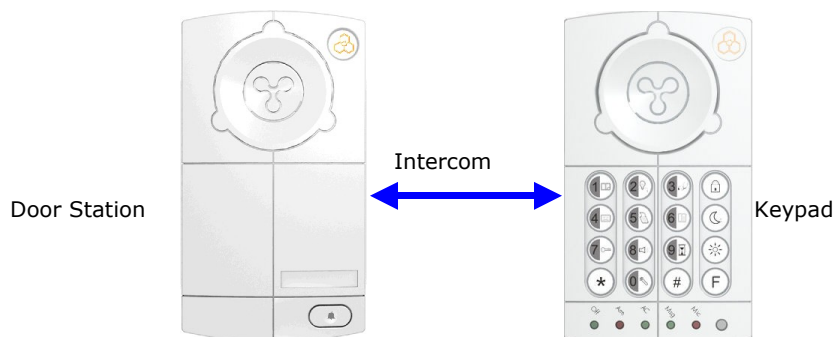
For the Door Station to Keypad intercom tuning, the following parameters affect the performance:
- **Location 135**, which adjusts the gain of the microphone for the KP during DP-KP intercom mode
- **Location 136**, which adjusts the gain of the speaker for the KP during DP-KP intercom mode
- **Location 137**, which adjusts the gain of the microphone for the DP during DP-KP intercom mode
- **Location 138**, which adjusts the gain of the speaker for the DP during DP-KP intercom mode

A simplified block diagram is shown below:

```
           136                   137
  ┌──────┐       ┌──────┐       ┌──────┐
  │      │ ◄──── │      │ ◄──── │      │
  │  KP  │       │ DSP  │       │  DP  │
  │      │ ────► │      │ ────► │      │
  └──────┘       └──────┘       └──────┘
           135                   138
```

The default. Minimum and maximum values are as follow:

Parameter	KP Intercom Mic Gain	KP Intercom Spk Gain	DP Intercom Mic Gain	DP Intercom Spk Gain
CF Index	79	80	81	82
Location	135	136	137	138
Default Value	11	3	1	1
Min	0 (low)	0 (high)	0 (low)	0 (high)
Max	20 (high)	4 (low)	20 (high)	4 (low)
Direction	Increase gain	Decrease gain	Increase Gain	Decrease Gain

- CF Index refers to the index in the Tuning Parameters Screen in Comfigurator
- Location is the Location number accessed in Engineer menu 7,4,1
- "Direction" tells if increasing the value of the parameter will increase or decrease the gain. For example, in Location 82, if the value is increased from 0 to 1, the Gain of the KP speaker will be reduced.

The Keypad to Door station Intercom is used when the Doorbell is pressed and the keypad is used to talk to the Door station.
Note that the set of parameters used is independent of other parameters used in adjustments for remote and local phone intercom
The Keypad and Door station must be located sufficiently far apart so that there is no acoustic feedback from one to the other.
If the sound in one direction is too soft or inaudible and the sound in the other direction is loud, then adjust the parameters to increase the Mic gain of one of the KP/DP, and perhaps compensate by reducing the gain of the corresponding speaker

REMOTE PHONE – KEYPAD / DOOR STATION INTERCOM (VIA GSM)

UCM/GSM Module

Remote Phone

Door Station

Note that this applies only when the intercom is between remote phone to Keypad/Door station via the GSM telephone number of the UCM/GSM.
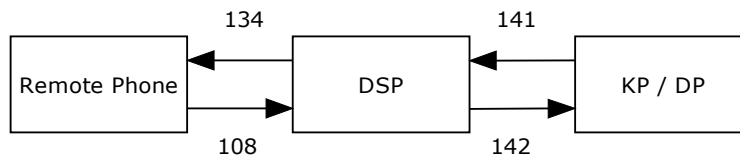
For the Remote Phone to Keypad / Door Station intercom tuning, the following parameters affect the performance:

- **Location 108**, which adjusts the gain of the microphone for the Remote Phone. Note that this applies to the various modes, and not just the intercom mode, e.g. for DTMF tone detection.
- **Location 134**, which adjusts the gain of the voice to Remote Phone. **Note that this applies to the various modes, and not just intercom mode.**
- **Location 141**, which adjusts the gain of the microphone for the KP / DP during Phone-KP / DP intercom mode
- **Location 142**, which adjusts the gain of the speaker for the KP / DP during Phone-KP / DP intercom mode

The default values are as follow:

Parameter	Remote Phone Intercom Mic Gain	Remote Phone Intercom Spk Gain	KP Intercom Mic Gain	KP Intercom Spk Gain
CF Index	52	78	85	86
Location	108	134	141	142
Default Value	12	1	7	0
Min	0 (low)	0 (high)	0 (low)	0 (high)
Max	20 (high)	4 (low)	20 (high)	4 (low)
Direction	Increase gain	Decrease gain	Increase Gain	Decrease Gain

A simplified block diagram is shown below:

```
           134                    141
  ┌──────────────┐  ◄──  ┌───────┐  ◄──  ┌─────────┐
  │ Remote Phone │       │  DSP  │       │ KP / DP │
  └──────────────┘  ──►  └───────┘  ──►  └─────────┘
           108                    142
```

Location 141 and 142 have been adjusted in the previous steps so Location 134 and 108 should be adjusted if necessary to get good performance for Mobile Phone to KPDP Via UCM/GSM

Non-Intercom Settings

The following Locations adjust the mic and speaker independently for non-intercom functions
- **Location 107** which adjusts the gain of the KP/DP microphone for recording
- **Location 54** which adjusts the volume of the KP voice menu (also in Voice Settings > KP Voice Volume). This should be changed using Voice Settings > Keypad Voice level
- **Location 1699** adjusts the gain of the voice and DTMF tones from the remote telephone line. **This should be changed using Voice Settings > Record Level**
- **Location 1706** adjusts the volume of the voice menu to the telephone line. **This should be changed using Voice Settings > Phone Voice Level**
- **Location 101** adjusts the DTMF detection Sensitivity for Local and Remote Phone
- **Location 1704** adjusts Record Compression of recorded messages. This can be changed using Voice Settings > Record Quality
- **Location 109** sets Record Mode AGC

Parameter	KP/DP Mic Recording Gain	KP Voice Menu Vol	Remote Phone Line in Gain	Telephone Voice Menu Vol
Index	51	Voice Settings > KP Voice Level	Voice Settings > Record Level	Voice Settings > Phone Voice Level
Location	107	54	1699	1706
Default Value	10	2	7	0
Min	0 (low)	0 (high)	0 (low)	0 (high)
Max	20 (high)	4 (low)	20 (high)	4 (low)
Direction	Increase gain	Decrease gain	Increase Gain	Decrease Gain

Parameter	DTMF Sensitivity	Record Compression	Record Mode AGC
Index	45	-	53
Location	101	1704	109
Default Value	18	0	1 (on)
Min	0 (most sensitive)	0 (high compression)	0 (AGC Off)
Max	29 (least sensitive)	2 (low compression)	1 (AGC On)
Direction	Reduce sensitivity	Low comp/better quality	-

DTMF Detection

The sensitivity of the system to detect DTMF tones is determined by two parameters – Location 1600 (Voice Settings > Record Level) and Location 101 (DTMF Sensitivity)
Location 1699 (Record Level) affects both Recorded message level as well as DTMF level

Location 1699 affects ONLY remote phone, not local phone. If there is a problem with detection of DTMF tones from a remote phone, increase the value at Location 1699, but check the local phone is also able to detect DTMF after the change.
Location 101 determines the sensitivity to DTMF signals, i.e. how small a signal can be detected as DTMF. The lower the number, the more sensitive the system is to a DTMF tone. The downside of too much sensitivity would be the greater chance of false detection is other sounds or speech detected as DTMF.
The default values work in most cases but due to the great variation in levels caused by the landline and mobile telephone networks the default values may not work well for all locations and networks

Telephone Recording Level

If the volume of recorded messages is too low when the message is recorded from the remote telephone call, change Record Level (Location 1699). This does not affect the intercom. Check that DTMF tones can still be detected after the change

Keypad Recording Level

If the volume of a message recorded on the keypad is too low, change the KP/DP recording gain (Location 51). This does not affect the intercom.

Record Mode AGC

AGC (Automatic Gain Control) is an electronic means of compensating for the variation in sound level during record mode so as to attempt to equalise the level of the voice recorded. Location 109 is normally set to 1 (AGC Enabled). This causes loud and soft voices to sound almost at the same level. A side effect is that some ringing noise may be heard after each word. AGC can be disabled by entering 0 in Location 109.

Keypad Voice Menu Volume

Use Voice Settings > Keypad Voice Level to change the voice menu volume on the keypad

Telephone Voice Menu Volume

Use Voice Settings > Phone Voice Level to change the voice menu volume on the telephone

Record Compression

In Location 1704, 00 is high compression (low quality, max recording time) and 02 is low compression (best quality, least recording time). For value 0, recording time is about 9 minutes. Value 1 gives recording time of 5 minutes and value 2 gives recording time of 4 minutes. Note that these times are approximate and depend of the type of speech recorded.

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