Synway ®

Synway CTI Series

SHT-16B-CT/cPCI 2.0

SHT-16B-CT/cPCI/FAX 2.0

SHT-16B-CT/cPCI/MP3 2.0

Analog Voice Board

Hardware Manual

Version 2.2

Synway Information Engineering Co., Ltd

www.synway.net

Contents

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Revision History

Version	Date	Comments
Version 1.0	2004-5	Initial publication
Version 2.0	2006-8	Changes: Made major hardware improvement, eliminated models with the front connection panel, and added illustrations of boards and modules for better understanding.
Version 2.1	2009-6	Changes: Added the CT_EN jumper and the description on it.
Version 2.2	2011-11	Changes: added a new module EM2V100.

Note: Please visit our website http://www.synway.net to obtain the latest version of this document.

Chapter 1　Overview

The CTI Series SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0, SHT-16B-CT/cPCI/MP3 2.0 are 16-channel analog voice boards with CompactPCI bus and hot-swap feature. All functions found on general voice boards and specific station boards are available with these boards by configuring the various functional modules in different ways.

1.1　Functions

- Supports ring-alert for external calls

- Station phones on-hook/off-hook detection

- Direct connection between trunk and station keeps call uninterrupted during power outage

- Multiple fax channels

- Calling party info (Caller ID) detection, DTMF and FSK support

- Activity/silence detection

- Automatic Gain Control (AGC) support in recording operation

- DTMF transmission and detection

- Automatic line voltage detection

- Automatically checks the number and the type of the modules on the board

1.2　Features

- **CompactPCI 2.1 Bus Support**

  Includes CompactPCI 2.1 bus with burst data transmission rate up to 133 MB/s; PNP　(plug and play) feature eliminates the need for jumper leads; supports hot swap while running the application software (most advanced hot-swap operation for CompactPCI system).

- **Connects via Rear Connection Panel**

  The use of the rear connection panel eliminates the need for reconnection upon changing the board, which facilitates system development and debugging, and enhances runtime stability.

- **Module Configurable**

  8 on-board dual channel modules can be freely arranged in pairs or groups for various complex, multi-functional applications, such as call center and recording

functions available on a single board.

- **On-board SIMM Slots**

Fit modules to board. Contacts on both sides of the SIMM slots greatly improve connection and ease installation.

- **Teleconferencing**

The flexible distributed conferencing system sets no limit on the number of simultaneous conferences and participants in each conference, allows monitoring and recording of the whole conference and each individual speaker.

- **RJ11 and DB44 Connectors Available**

A rear connection panel has eight 4-pin RJ11 jacks and a 16-way DB44 connector which can be directly connected to phone lines via a proper arrangement of lines and cables, making connection easy and malfunctions rare.

- **Optional Internal/External Ringing Current & Battery Feed Power Supply**

The external ringing current & battery feed power supply provides station modules with battery feed, and enables the phones which are linked to station channels to ring.

The ringing current module which may be optionally built on the rear connection panel supplies the internal ringing current and battery feed provided that it is working with the 48V IPC power supply.

- **Programmable Tone Detector**

Detects single or dual tones at any frequency, offering facility for use with a variety of PBXes and key telephone systems.

- **Specialized Driver Algorithm**

Uses SPECDial – a specialized driver algorithm - to perform a complete automatic dial process through analog lines. Accurately identifies called-party statuses and precisely distinguishes an answering machine from a fax machine that is responding at the remote end.

- **Echo Cancellation**

The self-adaptive echo cancellation feature effectively eliminates echoes under various conditions, which cancels out the effect of voice playback on DTMF and busy tones detection, avoids self-excited oscillation and howling, and minimizes the possibility of registering wrong DTMF and busy tones in a conference call.

- **Various CODECs Support**

Offers a large selection of voice CODECs, including hardware-based A-law (G.711), μ-law, IMA-ADPCM, software-based 16-bit linear PCM, MP3 and VOX.

● **Supports WAV File**

The recorded speech files can be edited and played by audio tools such as Cooledit.

● **Audio Output Interface**

The analog tone amplifier circuit equipped on the first channel and the audio output jack on the rear connection panel allow the board to connect directly with the headset or sound box, and enable the voice to be played to a specified channel by simple function calls.

● **TDM Capability**

The use of the on-board H.110 bus in a CompactPCI chassis facilitates smooth connectivity to third-party boards with H.110 bus for the transfer of acquired voice signals to other devices.

● **Unique Hardware Serial Number**

Each board has a unique hardware serial number written in the firmware to distinguish itself from other boards and prevent piracy. The number is available via an easy function call with applications.

● **Authorized Code Identification Circuit**

The on-board authorized code identification circuit is designed for software safety. Users can apply to our company for the authorized code.

● **Synway's Unified SynCTI Driver Development Platform**

Synway owns the intellectual property rights for the unified high-intelligence SynCTI driver development platform. Each system supports up to 2048 channels. Functions such as the detection and analysis of rings, tones and Caller IDs, are available via simple function calls on the driver platform, without having to understand complex call procedures.
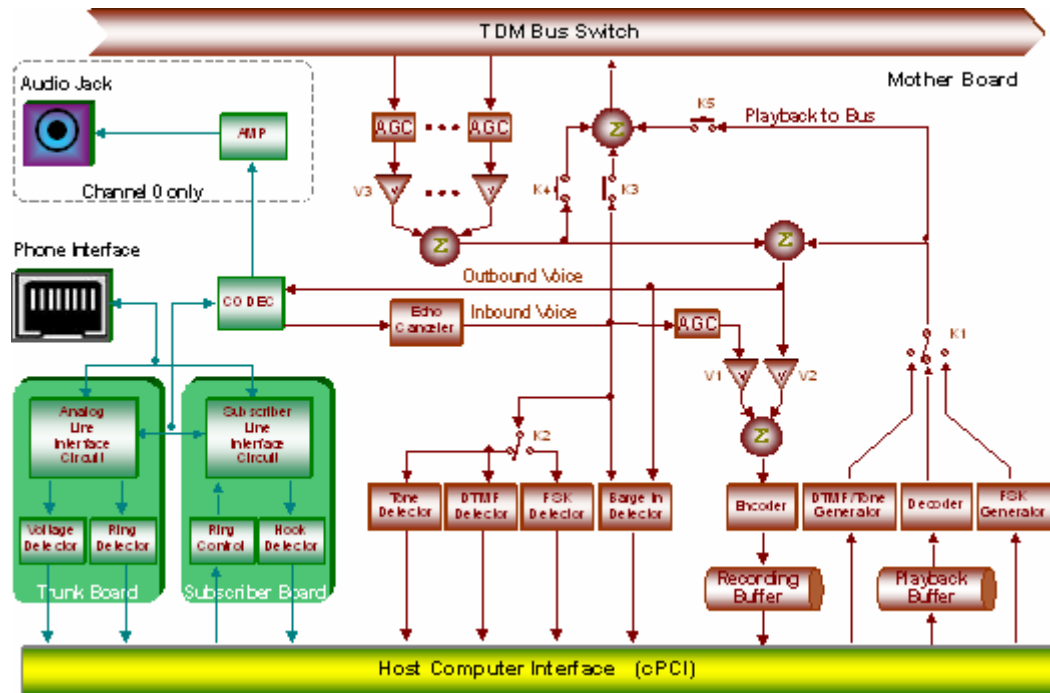
1.3   Operation Principle

Figure 1-1 Operation Principle

Notes: Channel 0 mentioned in this figure corresponds to Channel 1 marked on the board.

1.4   Functional Modules

These boards can be used with the following kinds of 2.0 modules from Synway: analog trunk module, station module, trunk-station composite module, trunk-record composite module and magnet module.

- **Analog Trunk Module**

This module is equipped with the lightning-proof circuit that reaches the telecom standard, and connects its corresponding channel directly to local lines from Central Office Terminal (COT), with ability to detect line voltage, diagnose line failure, and judge the on-hook/off-hook state of the station phone which is linked with it. See Figure 2-6 and Figure 2-7 for more information.

- **Station Module**

This module functions either as a station phone provided it links directly to a telephone or as an extension phone for the PBX, supporting delivery of the calling party information in FSK/DTMF to the phone. It uses -40V battery feed voltage and the integrated overcurrent/overvoltage circuit protection system, can accommodate a subscriber line in length of up to 5.5km. Refer to Figure 2-8 and Figure 2-9 for details.

- **Trunk-Station Composite Module**

This module contains an analog trunk channel and a station channel, ensuring safe communication via an automatic direct connection of the analog trunk channel and the station channel when the driver is not running or the PC is powered off. See Figure 2-10 and Figure 2-11 for details.

- **Trunk-Record Composite Module**

This module embraces two channels. One is for high-impedance recording in parallel and the other works as an analog trunk. See Figure 2-12 and Figure 2-13 for more information.

- **Magnet Module**

This module enables the direct connection of its corresponding channel with a magnet phone line so that to simulate the functions provided by magnet telephones. Refer to Figure 2-14 and Figure 2-15 for details.

- **EM2V100 Module**

A single EM2V100 module can transfer 2-line voice data and meanwhile perform EM control. Two EM2V100 modules can be used either as two EM trunk channels each of which carries 2-line voice data or an EM trunk channel which carries 4-line voice data. To use two EM2V100 modules, set 2 voice lines for incoming calls and another 2 voice lines for outgoing calls, and select one from the two pairs of E&M lines to perform EM control. See Figure 2-16 and Figure 2-17.

See below for the connection of the EM2V100 module.
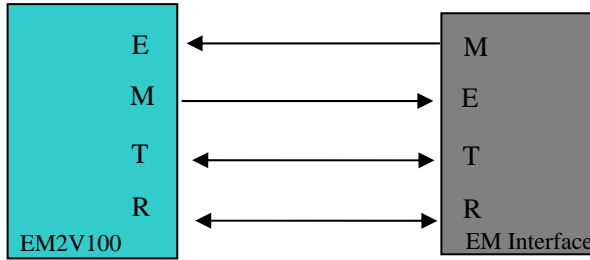
Connect to EM Interface Carrying 2-line Voice Data
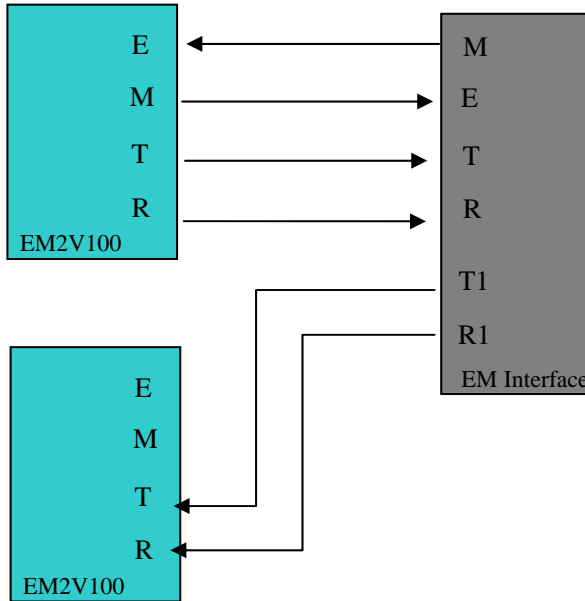
Connect to EM Interface Carrying 4-line Voice Data

See below for the pin definition of a single RJ45.

Pin No.	Pin Definition for EM2V100
1	E0
2	M0
3	Vp0
4	Vn0
5	E1
6	M1
7	Vp1
8	Vn1

See below for the pin definition of a single RJ11.

Pin No.	Pin Definition for EM2V100
1	E0
2	M0
3	Vp0
4	Vn0

Chapter 2   Installation

2.1   Hardware Structure

- **SHT-16B-CT/cPCI 2.0 or SHT-16B-CT/cPCI/FAX (MP3) 2.0 board**

Module Slot 1 (Ch1-Ch2)
Module Slot 2 (Ch3-Ch4)
Module Slot 3 (Ch5-Ch6)
Module Slot 4 (Ch7-Ch8)

Handle with a Lock

Module Slot 5 (Ch9-Ch10)
Module Slot 6 (Ch11-Ch12)
Module Slot 7 (Ch13-Ch14)
Module Slot 8 (Ch15-Ch16)

Jk11
Jk10
Jk12

S6

SHT-16-CT/CPCI 2.0
VER: XXX   XXXX.XX.XX

CT_EN Jumper

cPCI Connector with Alignment Pin

H.110 Bus Interface

cPCI Connector

Figure 2-1 Front View

Network Access License
Corporate Logo
XXXXXXX   Serial Number
SHT-16B/cPCI   Board Model

Figure 2-2 Rear View

● **SHT-16B-B2/cPCI rear connection panel**

cPCI Connector with Alignment Pin
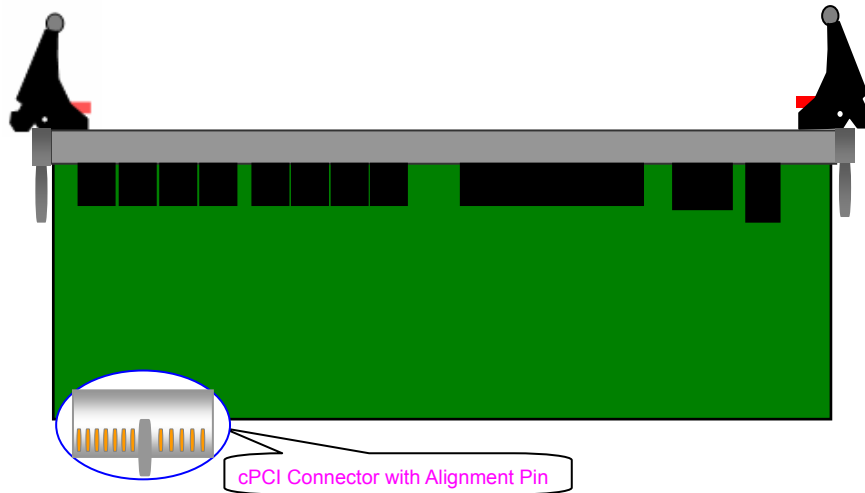
Figure 2-3 SHT-16B-B2/cPCI

● **SHT-16B-B3/cPCI rear connection panel**

Ring Generator

cPCI Connector with Alignment Pin
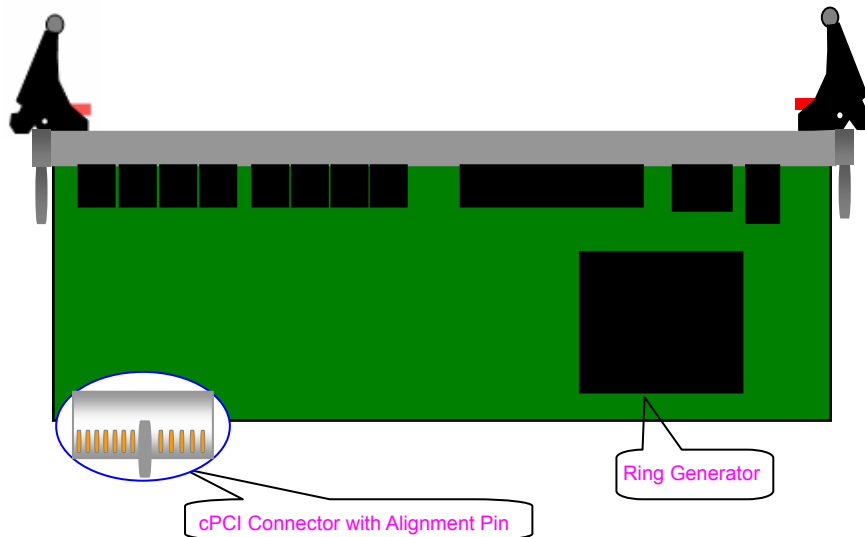
Figure 2-4 SHT-16B-B3/cPCI

Note: At present, there are two models of rear connection panel provided for use with the SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0 or SHT-16B-CT/cPCI/MP3 2.0 board. They are SHT-16B-B2/cPCI and SHT-16B-B3/cPCI. Users can choose either of them depending on real situation. The instruction below shows you how to make choice between the two models.

1) When using the ringing current & battery feed power supply from Synway, you should choose SHT-16B-B2/cPCI and properly configure the jumpers on the SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0 or SHT-16B-CT/cPCI/MP3 2.0 board before using this rear connection panel.

2) When using the IPC mainboard to supply both the ringing current and the battery feed (via –VBAT, VBTRTN, VRG and VRGRTN on the mainboard), you should also choose SHT-16B-B2/cPCI and properly configure the jumpers on the SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0 or SHT-16B-CT/cPCI/MP3 2.0 board before using this rear

connection panel.

3) When respectively using the IPC mainboard to supply the battery feed (via –VBAT and VBTRTN on the mainboard) and the voice board to offer the ringing current, you should choose SHT-16B-B3/cPCI and properly configure the jumpers on the SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0 or SHT-16B-CT/cPCI/MP3 2.0 board before using this rear connection panel.

Refer to 'Installation Procedure' below in this file for detailed information about the jumper configuration for these voice boards.

- **Indicators and interfaces on the SHT-16B-CT/cPCI 2.0 board and its rear connection panel**
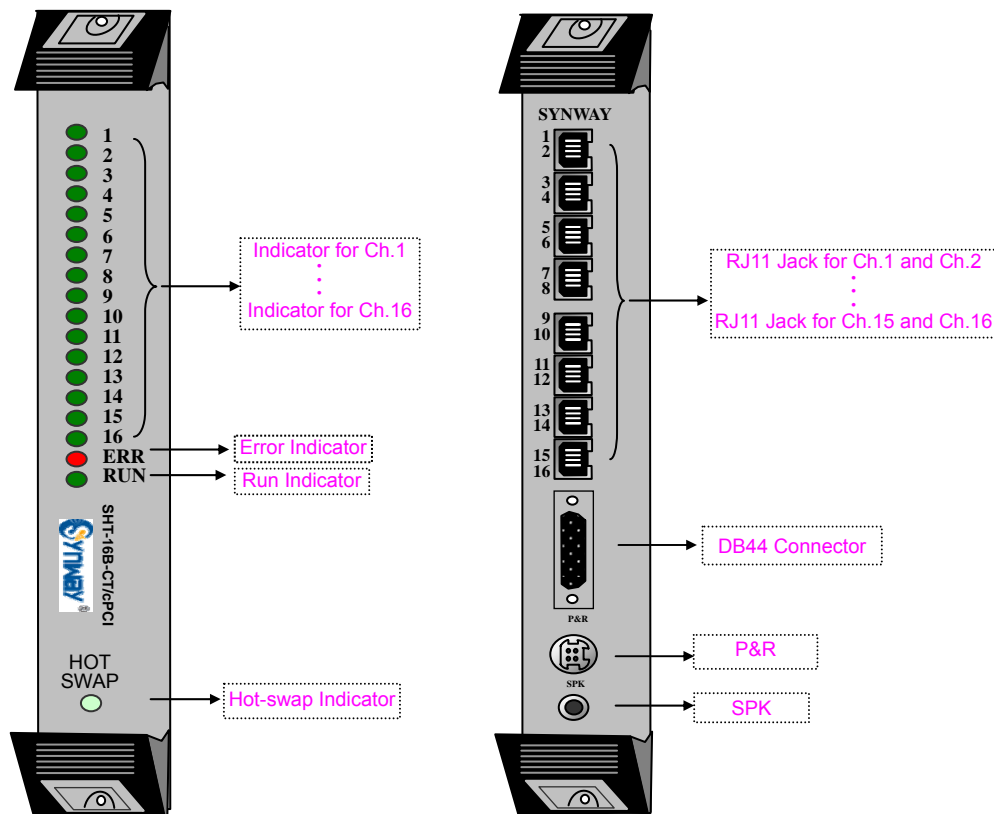
Figure 2-5 Indicators & Interfaces on Board and Rear Connection Panel

The above indicators and interfaces function as follows:

Indicators for 16 Channels	Lamp Status	Channel State
Green Lamps	ON	operating
	OFF	on-hook

Table 2-1 Indicators for 16 Channels

Run Indicator	Lamp Status	Runtime Status
Green Lamp	ON	not running

	OFF	not running
	FLASH	running

Table 2-2 RUN indicators

Hot-swap Indicator	Lamp Status	Runtime Status
Blue Lamp	ON	in the course of hot-swap
	OFF	normal

Table 2-3 Hot-swap Indicator

ERR: Error indicator

RJ11 Jack: links two voice paths (channels)

DB44 Connector: links all the 16 voice paths (channels)

P&R: An interface for ringing current and battery feed power supply

SPK: Audio output interface, which is a φ3.5 stereo jack

● **Analog Trunk Module**
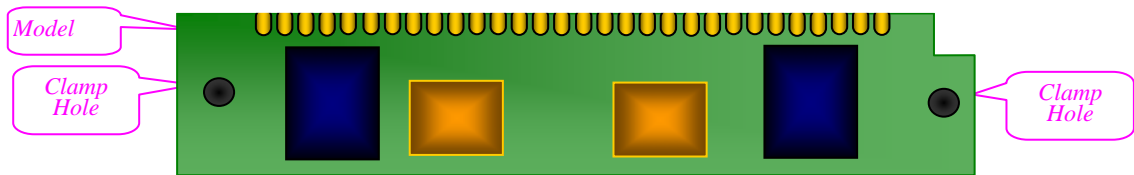
Figure 2-6 Front View
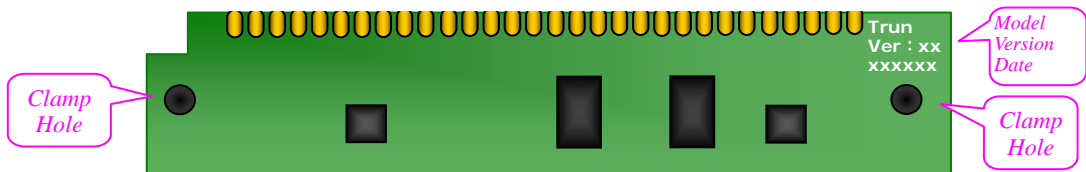
Figure 2-7 Rear View

● **Station Module**
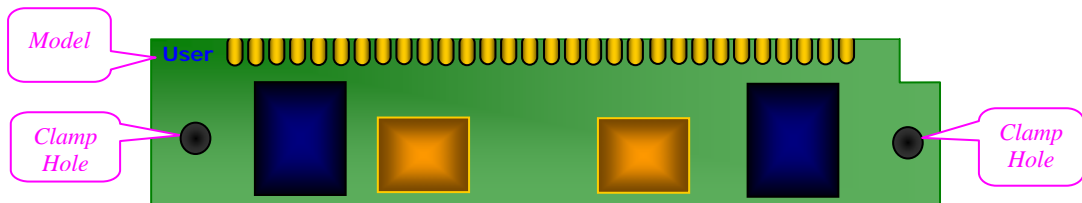
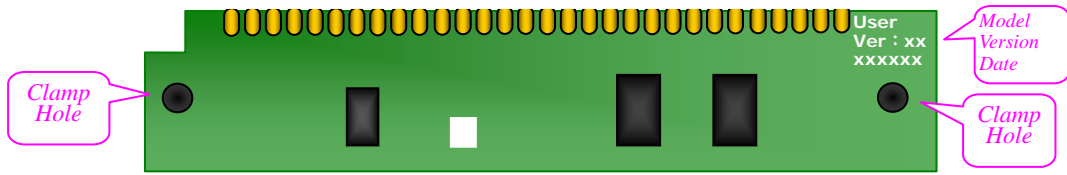

Figure 2-8 Front View

Figure 2-9 Rear View

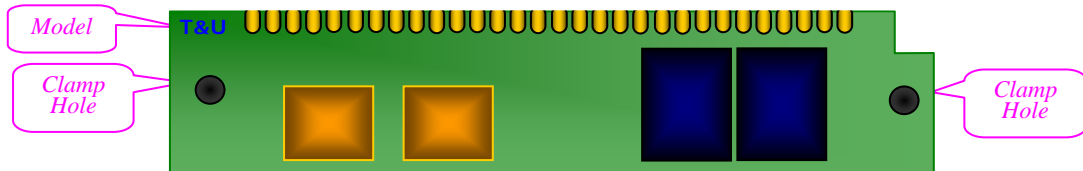- **Trunk-Station Composite Module**

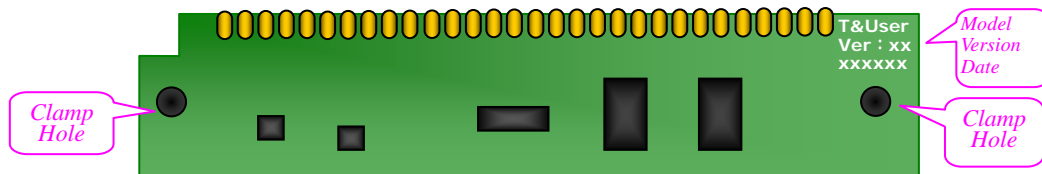Figure 2-10 Front View

Figure 2-11 Rear View

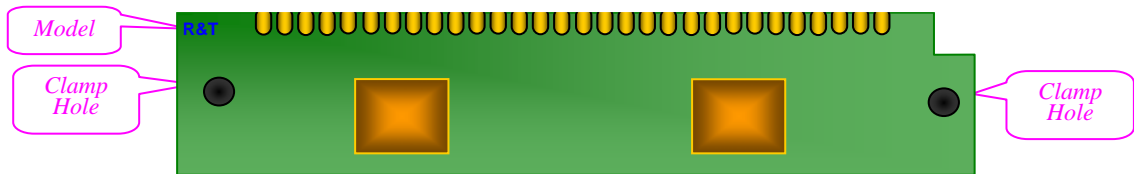- **Trunk-Record Composite Module**

Figure 2-12 Front View
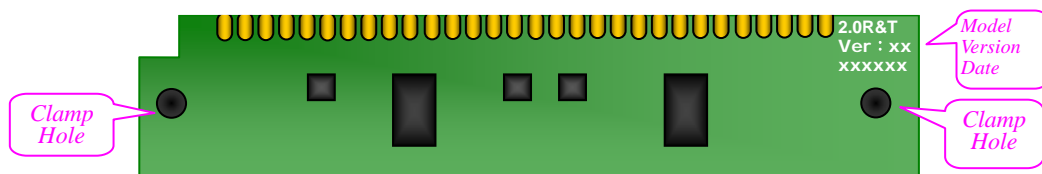
Figure 2-13 Rear View

- **Magnet Module**

Figure 2-14 Front View
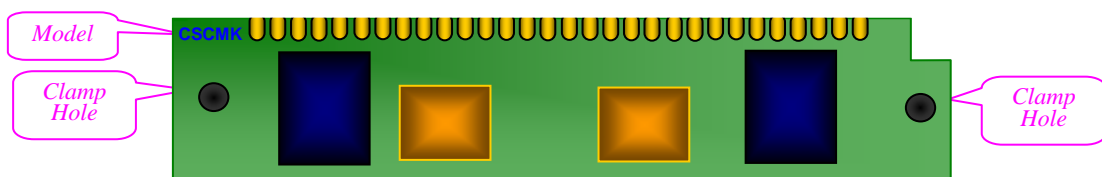
Model
Version
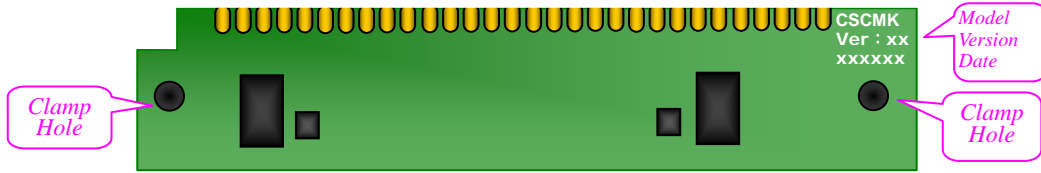*Date*

Clamp Hole

Clamp Hole

Figure 2-15 Rear View

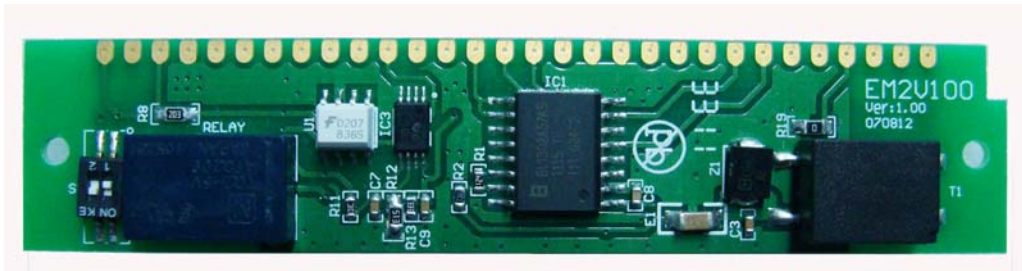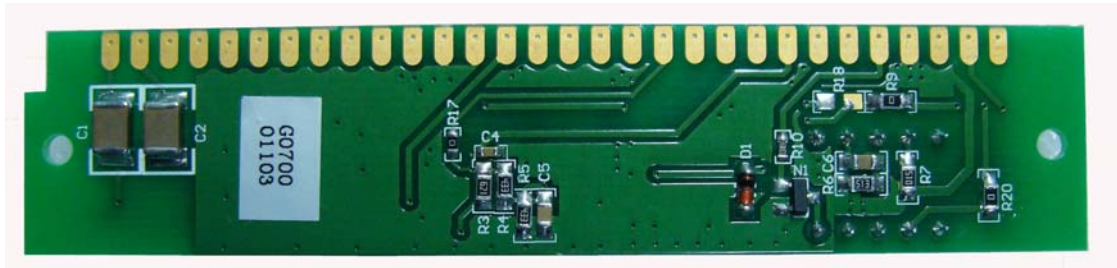● **EM2V100 Module**

Figure 2-16 Front View

Figure 2-17 Rear View

2.2   System Requirements

<u>Host System Requirements</u>

CPU: 300MHz Intel® Pentium®Ⅱ or above

Memory: 256M or more

HD: Depends on individual requirements

<u>Supported Operating Systems</u>

Refer to *SynCTI Programmer's Manual.pdf*.
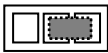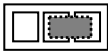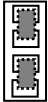
2.3 Installation Procedure

Step 1: Plug the desired modules into the module slots on the board.

Step 2: Configure the jumpers on the board.

Skip this step if station modules are not used.

① If using the recommended ringing current & battery feed power supply from Synway, you should use the jump cap to create shorts across the 1st and 2nd pins on the JK10 jumper, the 1st and 2nd pins on the JK11 jumper, and the two pins on the JK12 jumper. In this case, the SHT-16B-B2/cPCI rear connection panel should be used with the board.

② If using the IPC mainboard to supply the battery feed and the board to offer the ringing current, you should use the jumper cap to short-circuit the 1st and 2nd pins on JK10, two pairs of pins (the 1st and 2nd pins as well as the 3rd and 4th pins) on JK11, and disconnect the two pins on JK12. In such case, the SHT-16B-B3/cPCI rear connection panel should be used with the board.

③ If using the IPC mainboard to supply both the ringing current and the battery feed, you should use the jumper cap to short-circuit the 2nd and 3rd pins on JK10, the 3rd and 4th pins on JK11, and also the two pins on JK12. In this case, the SHT-16B-B2/cPCI rear connection panel should be used with the board.

④ To configure the CT_EN jumper, short-circuit it if the cPCI industrial computer has no CT-BUS slot on the backboard, or, the indicator will be on blue all the time and the board can not work normally; disconnect it if the cPCI industrial computer has a CT-BUS slot on the backboard, or, the hot-swap operation may bring a damage to the computer or the board.

See Table 2-4 below for more information (Refer to Figure 2-1 for where the JK10, JK11 and JK12 jumpers are located on the board).

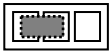| Source of ringing current & battery feed	JK10	JK11	JK12	Rear Connection Panel
Using ringing current & battery feed power supply	▭▣	▦	▣	SHT-16B-B2/cPCI
Using IPC mainboard for battery feed	▭▣	▦	▯▯	SHT-16B-B3/cPCI

Using IPC mainboard for both ringing current and battery feed				SHT-16B-B2/cPCI

Table 2-4 Source of Ringing Current & Battery Feed and Alternative Jumper Configuration

Note: Users should confirm the jumper configuration or reset the jumpers depending on real situation before using these boards.

Step 3: Fit the board and the rear connection panel into a pair of empty slots on the CompactPCI chassis.

With the board completely inserted, push the upper and bottom handles inwards at the same time until a 'click' sound is heard and the red locks flip into position. The board is now properly fitted. The voice board can be further fastened with screws (on the outside of the upper and bottom handles) for extended use and prevention of accidental removal.

Notes:

① The rear connection panel should be inserted into the slot which corresponds to that of the voice board.

② Due to the structural design of the cPCI IPC, it is necessary to push the board home into the slot until it can go no further, and ensure that it is not inclined at an angle before applying lever action on the handles to secure it. Connecting parts on the mainboard of the IPC may be damaged if:

    (I)   Handles are used too early
    (II) Handles are used while the board is inclined
    (III) Force on handles is not applied evenly.

③ Board insertion is allowed when computer is powered on. However, as strong static electricity may lead to damages, the operator should touch a grounded conductor to discharge the static electricity on him before inserting the board.

Step 4: Connect to analog phone lines or other input signals.

There are two types of interfaces-RJ11 and DB44 connectors-on the SHT-16B-B2/cPCI or SHT-16B-B3/cPCI rear connection panel, which correspond to the 16 voice channels on the SHT-16B-CT/cPCI 2.0, SHT-16B-CT/cPCI/FAX 2.0 or SHT-16B-CT/cPCI/MP3 2.0 board.

Each rear connection panel has eight 4-pin RJ11 jacks. Each RJ11 jack can be connected to a 4-lead line that corresponds to two channels (See Figure 2-5): The middle two pins correspond to an odd-numbered channel (e.g. the 1st, 3rd, 5th, 7th… channel), and the outer two pins to an even-numbered channel (e.g. the 2nd, 4th, 6th, 8th… channel). Pins in DB44 connector are illustrated and described in Figure 2-18 and Table 2-5 below, following which users can connect them with 16 voice channels via a

proper arrangement of lines and cables.
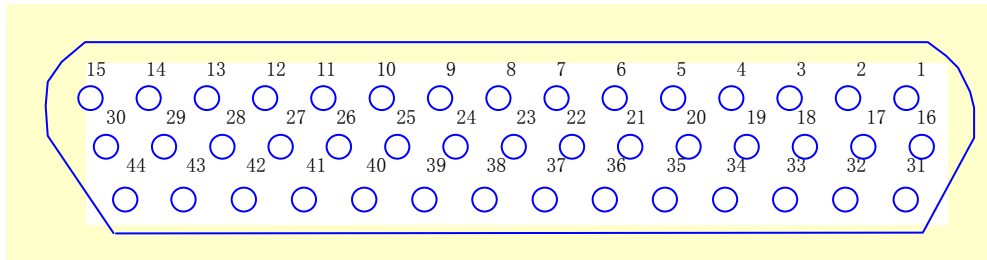
Figure 2-18 Pin Layout for DB44

Channel No.	Pin No.	Polarity	Channel No.	Pin No.	Polarity
1	44	+	9	23	-
	43	-		8	+
2	30	-	10	22	-
	15	+		7	+
3	29	-	11	21	-
	14	+		6	+
4	28	-	12	20	-
	13	+		5	+
5	27	-	13	19	-
	12	+		4	+
6	26	-	14	18	-
	11	+		3	+
7	25	-	15	17	-
	10	+		2	+
8	24	-	16	16	-
	9	+		1	+

Table 2-5 Pin Description for DB44

Notes:

① The remaining few pins on DB44 unmentioned above stay unused.

② Each RJ11 jack can be connected to lines via a 2-way hub.

③ See Table 2-5 for correct channel number and pin number and polarity when connecting DB44 to lines.

Step 5: Fit the composite module or the magnet module.

So far there are two kinds of composite modules available for CTI series. They are the trunk-station composite module and the trunk-record composite module.

The trunk-station composite module may not be used if direct connection between trunk and station which keeps call uninterrupted during power outage is not required by the system. When it is used, the station phone and the phone line which both share the same module can be directly linked before the board is powered on or the driver software is initialized to allow emergency telecommunication. Once the board application program starts to run, the link automatically breaks and the internal and external lines become independent.

If the trunk-record composite module is used, the recording channel and the recorded phone lines should be connected in parallel.

If the magnet module is used, only magnet telephones are allowed to connect with it.

Note: When composite modules are used, the adjacent two channels are by default a station/recording channel and an analog trunk channel. Users can set whichever channel to be a station/recording channel or an analog trunk one by modifying the configuration file.

Step 6: Connect to the EM2V100 module.

Skip this step if EM2V100 modules are not used.

To use the EM2V100 modules, there are two situations as shown below.

1) Used as an EM trunk channel carrying 2-line voice data

In such situation as a single EM2V100 module is used as an EM trunk channel carrying 2-line voice data, follow the figure 'Connect to EM Interface Carrying 2-line Voice Data' to connect lines. To be exact, connect E at the local end to M at the remote end, M at the local end to E at the remote end, and connect TIP and RING at the local end correspondingly to TIP and RING at the remote end.

Case: Use SHT-8B/PCI which includes RJ11 jacks as the motherboard to set up an EM trunk channel carrying 2-line voice data. See below for connection (refer to the pin definition of a single RJ11 jack).

1. E0   ------------→ 2. M0

2. M0   ------------→ 1. M0

3. Vp0   ------------→ 3. Vp0

4. Vn0   ------------→ 4. Vn0

Local   Remote
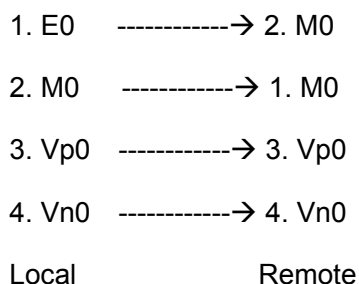
2) Used as an EM trunk channel carrying 4-line voice data

In such situation as two EM2V100 modules are combined to work as an EM trunk channel carrying 4-line voice data, follow the figure 'Connect to EM interface Carrying

4-line Voice Data' to connect lines. There should be two pairs of voice lines for voice transmission, and a pair of E&M lines for EM control.

Case: Use SHT-16B-CT/PCI which includes RJ45 jacks as the motherboard to set up an EM trunk channel carrying 4-line voice data. See below for connection (refer to the pin definition of a single RJ45 jack).

1. E0   ------------→ 2. M0

2. M0   ------------→1. M0

3. Vp0   ------------→ 3. Vp0

4. Vn0   ------------→ 4. Vn0

5. E0   ------X----→ 5. E0

6. M0   ------X----→ 6. M0

7. Vp0   ------------→ 7. Vp0

8. Vn0   ------------→ 8. Vn0

    Local   Remote

Note: In case two EM2V100 modules are combined to work as an EM trunk channel carrying 4-line voice data, only one pair of E&M lines need to be used. Therefore, the pair of E&M lines on the first module should be connected to the remote end, while that pair on the second module is suggested not to be connected.

Step 7: Connect to the ringing current & battery feed power supply.

Skip this step if the ringing current & battery feed power supply from Synway is not used.

First of all, determine the source of the ringing current and the battery feed. If you are using the external ringing current & battery feed power supply from Synway, note that the plug has a peculiar design for the prevention of improper insertion and extraction. The correct way is to hold the plug body (not the locking ring, or it cannot be fully inserted) when inserting the plug home into the socket, and to grasp the locking ring (not the plug body or the conductor) when pulling the plug out from the socket. See Figure 2-19 below.
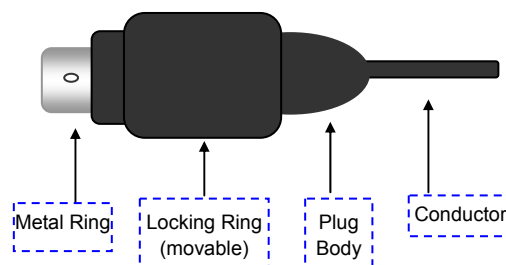
Figure 2-19 Ringing Current & Battery Feed Power Supply

Step 8: Connect the sound box or other proper sound devices.

Skip this step if there is no need to 'monitor in real time' or 'play'.

Regarding how to choose proper sound devices, refer to 'Input/output Interface' and 'Audio Specifications' in *Appendix A Technical Specifications*.

Note: The first module slot on the board must be fitted with a module should you wish to play sound via the amplifier.

Step 9: Connect H.110 bus.

The IPC has H.110 slots on the chassis and connecting lines already fixed on them. By installing all the necessary boards, the H.110 buses would have already been inter-connected. Hence, no additional work by the user is needed provided each board is correctly and properly installed.

Step 10: Boot your computer and install the driver.

Regarding driver installation, refer to *Driver Installation Manual*.

Key Tips:

- As the system is expected to run for long hours unmannedly, 'energy-saving' mode should be turned off for both the CPU and the HD in CMOS or WINDOWS operating system. This is to ensure full-speed operation of the computer, or it may lead to a drop in performance or unexpected errors after running for some time.

- A chassis installed with voice boards must be grounded for safety reasons, according to standard industry requirements. A simple way is earthing with the third pin on the plug. No or improper grounding may cause instability in operation as well as decrease in lightning resistance.

2.4   Precaution on Hot-swap Operation at Runtime

The board should not be removed while user applications are running, or it may cause instability problems such as system halt or application failure. The correct way is to release the bottom handle (by the red lock on the handle) and notify the application to stop operations on the board, i.e. upon releasing the board, to wait for the hot-swap blue lamp to light up before pulling it out from the slot.

Also note to never remove the board when it is being initialized. You must end the application before performing a proper board insertion or extraction following the above steps.

This restriction however, applies only when the board is under operation by a user application.

During software runtime, the run indicator blinks at 1-second intervals if the board is working properly, or, it will go on and off at irregular intervals if the driver software detects abnormal behavior by the board and prompt users to replace the existing board. The new board should be of the same model and placed in the same slot as the previous, or software parameters will have to be reconfigured. If the rear connection panel is used, remember to move it along with the voice board. The rear connection panel can be hot-swapped at anytime without interrupting runtime.

Note: Releasing the bottom handle at runtime will cause your board to stop operating!

Appendix A Technical Specifications

Dimensions

Board: 230×163mm2 (excluding handles)

Rear connection panel: 230×82mm2

                (excluding handles)

Weight

Board: ≈ 500g (including 8 dual channel modules)

Environment

Operating temperature: 0℃—55℃

Storage temperature: -20℃—85℃

Humidity: 8%— 90% non-condensing

Input/output Interface

Headset jack: One φ3.5 stereo jack

Telephone line jack: Eight 4-pin RJ11 jacks; DB44

Audio Specifications

CODEC: CCITT A/μ-Law   64kbps,

        IMA ADPCM   32kbps

Output power: ≥50mW

Distortion: ≤2%

Frequency response: 300-3400Hz(±3dB)

Signal-to-noise ratio: ≥38dB

Echo suppression: ≥40dB

Maximum System Capacity

Up to 10 boards concurrently per system; up to 16 channels per board

Power Requirements

+5V DC: 600mA

-12V DC: 80mA

+12V DC: 300mA

Maximum power consumption: ≤12W

Impedance

Input impedance: ≥1MΩ/500V DC;

           ≥10kΩ/1000V AC

Insulation resistance for PC isolation from telephone line: ≥2MΩ/500V DC

Telephone line impedance: Compliant with the national standard impedance for three-component network

Audio Encoding & Decoding

16Bit PCM	128kbps
8Bit PCM	64kbps
A-Law	64kbps
μ-Law	64kbps
VOX	32kbps
ADPCM	32kbps
GSM	13.6kbps
MP3	8kbps

Sampling Rate

8kHz

Safety

Lightning Resistance: Level 4

Certification: FCC; CE; CCC

Appendix B Technical/sales Support

Thank you for choosing Synway. Please contact us should you have any inquiry regarding our products. We shall do our best to help you.

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