VE2DX Electronics Design Inc.

CT17B ICOM VERSION 2 CI-V HUBS

WITH TrueCIV TECHNOLOGY.

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VE2DX CT17B User manual Version 02.06.00

Date	Name	Comments	Revision
17 April 2020	VE2DX	Release the first version	01.01.00
03 August 2023	VE2DX	Manual update to the new design, including TureTTL	02.00.01
Sept 2023	VE2DX	Added TrueTTL/TrueCIV info	02.03.00
October 2023	VE2DX	Added Operational info	02.04.00
6 October 2023	VE2DX	Draft Release	02.04.09
10 October 2023	VE2DX	Release	02.05.00
11 October 2023	VE2DX	Expanded 705 section	02.05.01
11 October 2023	VE2DX	Made changes to Windows 10 section	02.05.02
11 October 2023	VE2DX	Updated TrueCIV Section	02.06.00

! Warnings !

!! Read Very Carefully !!

Before plugging in ANY device's CI-V or USB port, you MUST ensure all equipment and power sources are turned OFF.

(Radios, Power supplies, accessories, PC, etc...)

Before plugging in the CT17B V2 into a radio or OEM device, ALWAYS check your user radio or OEM device manual to identify the proper CI-V port connection. CT17B V2 can be damaged or can damage the radio or OEM device if not plugged into the correct port, such an error would NOT be covered by warranty.

1. Introduction:

Congratulations on purchasing the **VE2DX ICOM CT17B© VERSION 2 CI-V HUB** with **TrueTTL/TrueCIV technology.** The **CT17B© V2** is an ICOM protocol (Called CI-V) distribution unit that lets you link together multiple ICOM and non-ICOM Radios or devices supporting the ICOM CI-V protocol.

The new 2023-based design now includes the VE2DX TruTTL© technology that features VE2DX advanced filtering and VE2DX automatic TTL leveling technology.

2. Technical information:

CI-V protocol is a straightforward ASCII protocol, but.. CI-V also defines the communication architecture that links the ICOM Radios with other ICOM Radios or OEM CI-V devices based on the CSMA/CD standards variant adapted by ICOM. It ALSO defines the hardware infrastructure that transports this communication based on TTL standards.

All devices being used together MUST run at the same speed. The higher your speed, the less collisions and the smoother your operations. The default operating speed is 9600bps.

The ICOM CI-V architecture also defines that multiple radios or devices can use the same common bus. There are no limitations on the maximum number of devices on the CI-V bus, but again, a good practice is to separate groups on separate hubs and keep the number as low as possible. The higher the number of devices on a single bus, the higher the number of collisions WILL slow your communications.

On the Hardware side, the CI-V is based on straightforward TTL (0 - +5VDC) hardware. It is used in CI-V as a one-wire approach where RX and TX are on the same wire, thus creating a duplexed hardware protocol.

This environment is collision-prone and is based on **Carrier-sense multiple access with collision detection** (**CSMA/CD**). This means the device is listening to the CI-V bus while transmitting and may interrupt transmission if it thinks it came into collision with another message on the CI-V bus and retry after a random amount of time. Most OEM devices do not follow this correctly; ICOM radios do.

ICOM CT17 unit was designed in the late 1970s.

The **ICOM CT-17** is the original ICOM manufactured unit in the 80s. It was made with 4 CI-V ports and a DB25 interface for the computer. It also needed an external 12VDC power source. It was not made for significant evolutions with Ham Radio station automation PCs.

3. Description:

The **VE2DX Electronics Design Inc. CT17B © V2** is an original ICOM CT-17 evolution. The original **VE2DX Electronics Design Inc. CT17B © V2** was introduced in 2020, and the **VE2DX Electronics Design Inc. CT17B © V2** was introduced at Dayton Hamvention in May 2023 and officially released at Hamxeposition in August 2023. It comes in multiple variations with 5, 6, and 7 ports.

a. CT17B Five ports family

VE2DX Original CT17B-5 © 2020 design.

The **CT17B © comes in multiple variations.**

- **CT17B-5 ©** is a five-port CI-V unit and RF filtering.
- **CT17B-5 V2 ©** is a five-port CI-V unit with added filtering and TrueCIV©.
- **CT17B-6USB V2** © a 5 CI-V ports CI-V and one port USB with added filtering and TrueCIV©.
- **CT17B-6BT V2** © a 5 CI-V ports CI-V and Bluetooth with added filtering and TrueCIV©.
- **CT17B-7DM V2** © a 5 CI-V ports CI-V with Bluetooth and one port USB with added filtering and TrueCIV©.

Note:

The CT17B-6BT and CT17B-7DM are the only ICOM CI-V Hubs that will support Bluetooth ICOM IC-705. By linking an IC-705 via Bluetooth, you automatically create five physical CI-V ports.

b. CT17B© V2 RFI protection

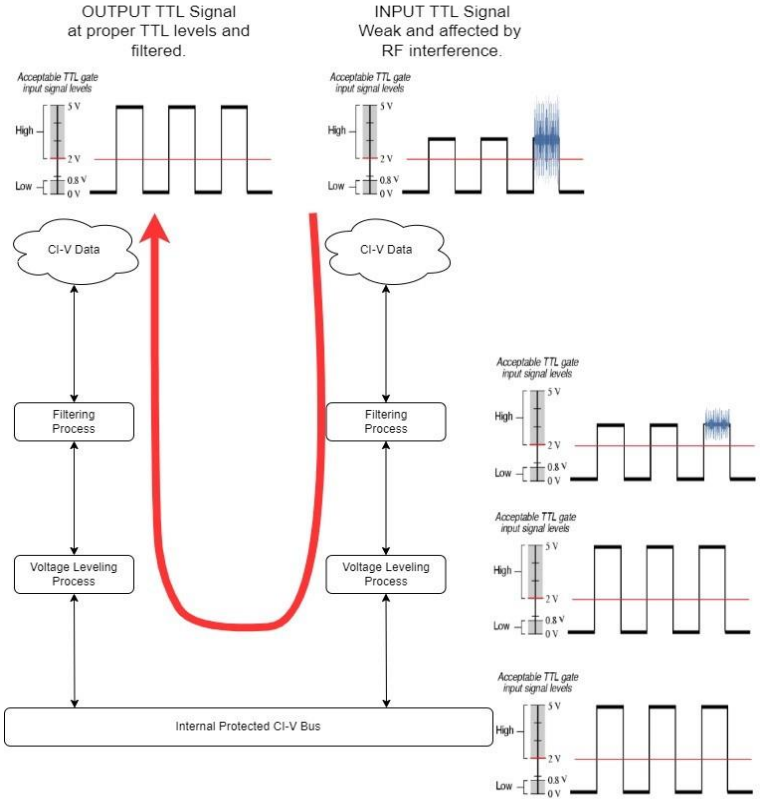
One significant factor in our design was RFI. Ham radio stations have to deal with RFI daily, and we wanted to help with our strategy. To do so, we isolated every port with proper RFI filtering.

In our new **V2 © versions,** we expanded this filtering to **EVERY** external electrical connection. This means all ground connections and power and external signal connections are filtered independently before reaching any internal circuitry of the **CT17B© V2**, thus optimizing the RF filtering.

c. TrueCIV©

TrueCIV© is the **VE2DX TrueTTL© technology** applied to **ICOM CI-V architecture**. All **VE2DX CT17B© V2** devices come with **TrueCIV** inside.

TrueCIV will monitor all **CI-V TTL signals** after **advanced filtering** and maximize the TTL to a maximum TTL standard voltage of 5 Vdc at all times. Thus, if any RF interference is left on the incoming signals, the **VE2DX TrueCIV©** process will eliminate any RF gone and output signals free of interferences, and the output will always be at a maximum TTL voltage of 5Vdc, whatever the original was.



VE2DX TrueTTL/TrueCIV.

i. Why TrueTTL.

Improper or weak TTL voltage levels is a common issue in Amateur Radio with DIY projects and even some commercial products, often using 3.3vdc outputs, instead of the expected proper 5vdc TTL/CI-V levels. Even if they are within TTL specifications, the problem with these voltage levels is that it makes then signals more prone to interference and signal loss.

In the new generation of VE2DX 2023 product offering, each port and all power or grounds are ALL RF isolated, all ports are also equipped with voltage levels monitoring and correcting based on VE2DX TrueTTL © 2023 technology.

TrueTTL was created in the summer of 2023 by Richard G. Desaulniers Sr., **VE2DX, of VE2DX ELECTRONIC DESIGN INC.** It is a new technology design that combines filters incoming TTL signals from RF interferences also implementing added filtering on every power and ground connections of the design and monitors the incoming control signals for proper TTL voltage levels and corrects them if they are too low, to make TTL signal processing and filtering more efficient and reliable.

Once a signal is detected, it is filtered for possible interferences, then converted to a common working voltage on.

The process can be used in a bidirectional circuit like with ICOM CI-V. The signal is first filtered and if the incoming signal does not have proper or has weak TTL levels, it is converted to the common Internal TTL working voltage and either fed to the device or shared on a common work bus to be used by other IOs or devices attached to the bus at proper filtered and levels.

In a CAT environment, both the Input and Output signal go through the TrueTTL processing, thus making certain that Interferences are cleaned out and that the TTL levels are as expected.

This process eliminates interferences and low level signals and offers the device(s) clean working signal for better data processing.

ii. TrueCIV

TrueCIV, is the bidirectional application of TrueTTL in an ICOM CI-V environment. It is important to understand the ICOM`s CI-V design and protocol is a multi-device common bus approach that does encounter unmanaged collisions. Thus, it is important in such an environment to have interference free signals at maximum TTL levels since they may encounter collisions from other devices, and the destination device may have to decide between the signals presented to him, this said obviously a routing device is the best approach to handle collision management and VE2DX ELECTRONIC DESIGN INC. is working in 2023 on such a solution that WILL include our TrueCIV technology.

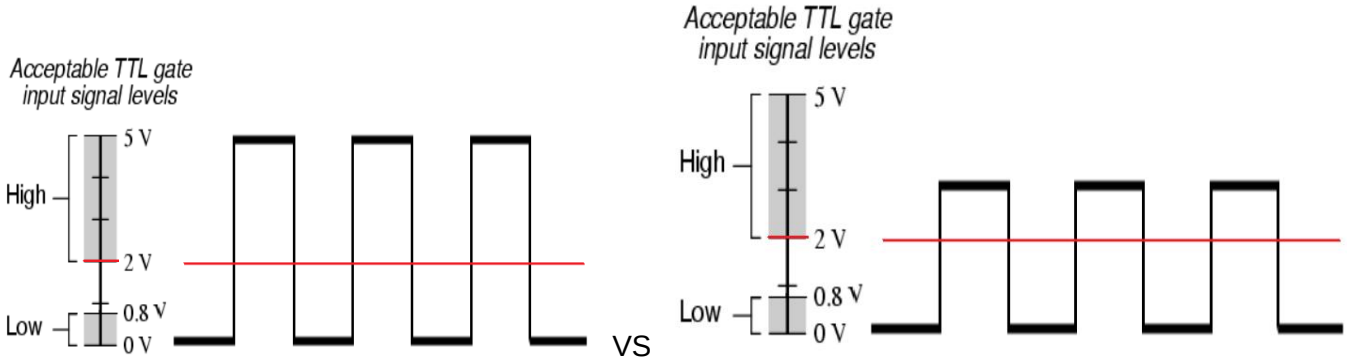
iii. TrueCAT.

TrueCAT, is the application of TrueTTL technology in a Yaesu, Kenwood or other radio environment using one to one interconnection. Unlike with TrueCIV the implementation of TrueCAT is simpler since the IOs are NOT bidirectional, the TX and RX are clearly separated in such an environment. Thus, each signal are handled separately. TrueCAT can be used for TLL linked devices, but also for RS232c linked devices, in such a situation TrueCAT is used to clean and processed signals in and out of RS232c conversion on the TTL side, making certain it is clear of interferences and converted properly.

iv. Application of TrueTTL.

□ 5vdc vs 3.3vdc in TTL environment.

The graphic below shows a normal CI-V signal vs a 3.3vdc signal in reference to standardized TTL levels;

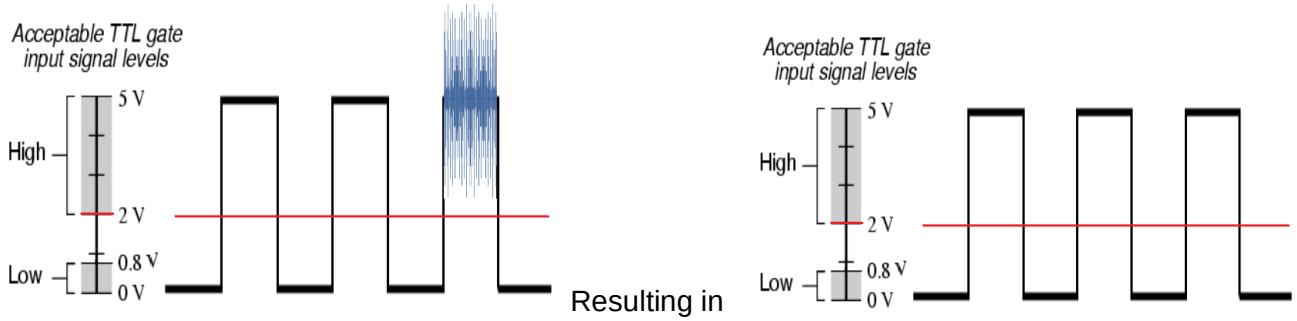


As you can see both are within standardized TTL Level, but at 3.3vdc the signal is much closer to triggering thresholds.

i. TTL handling of interferences.

□ 5vdc with interference in TTL environment.

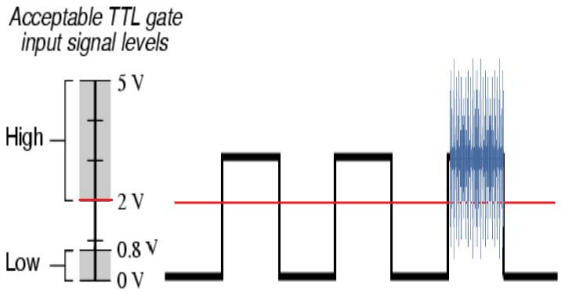
Let's introduce some interferences in the equation on a proper TTL signal and see the result:



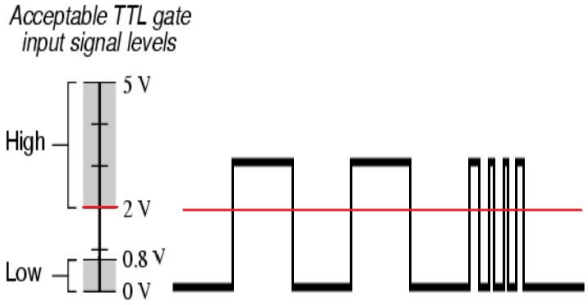
Because the TTL Levels were at 5vdc, the interference did not reach trigger thresholds of the TTL standards, and the device properly decoded the signal, thus the interferences must be larger before the TTL signal is corrupted.

□ 3.3vdc with interference in TTL environment.

Now let's apply the same interference to a TTL signal with 3.3vdc levels:



Resulting in



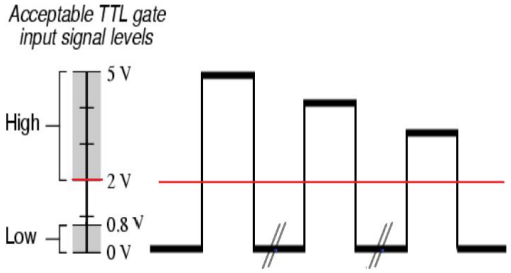
Same test with TTL levels at 3.3vdc clearly shows that multiple peaks in the interference resulted in triggers in the attached device decoding of the signal, this is because the 3.3vdc levels used are closer to the trigger levels in the TTL standards, thus the data is corrupted more easily.

ii. TTL handling of signal lost.

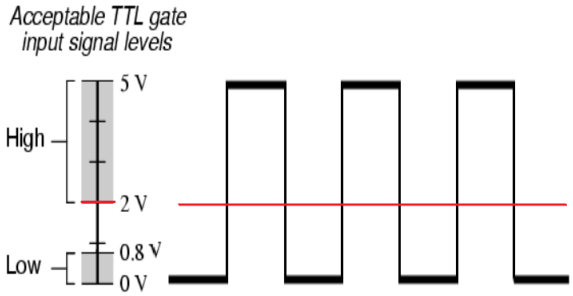
Let's look at the effect that lower voltage levels may have on the resulting decoded data based on signal loss caused by cable loss or distance.

□ 5vdc TTL handling of signal lost.

On a proper TTL level signal, applying a 2vdc signal lost to the signal, the signal is still within TTL Level standards having no effect on the resulting data:



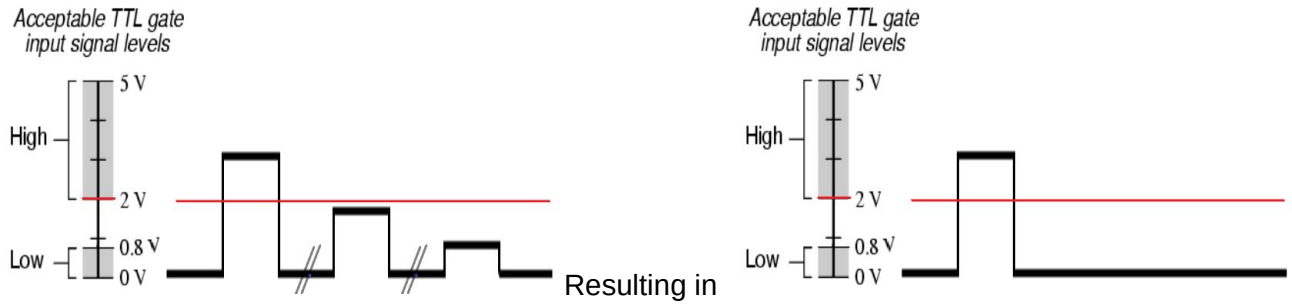
Resulting in



The resulting data was not affected by the signal loss of 2 vdc.

□ 3.3vdc TTL handling of signal lost.

Let`s apply the same signal loss of 2vdc to a 3.3vdc TTL signal:

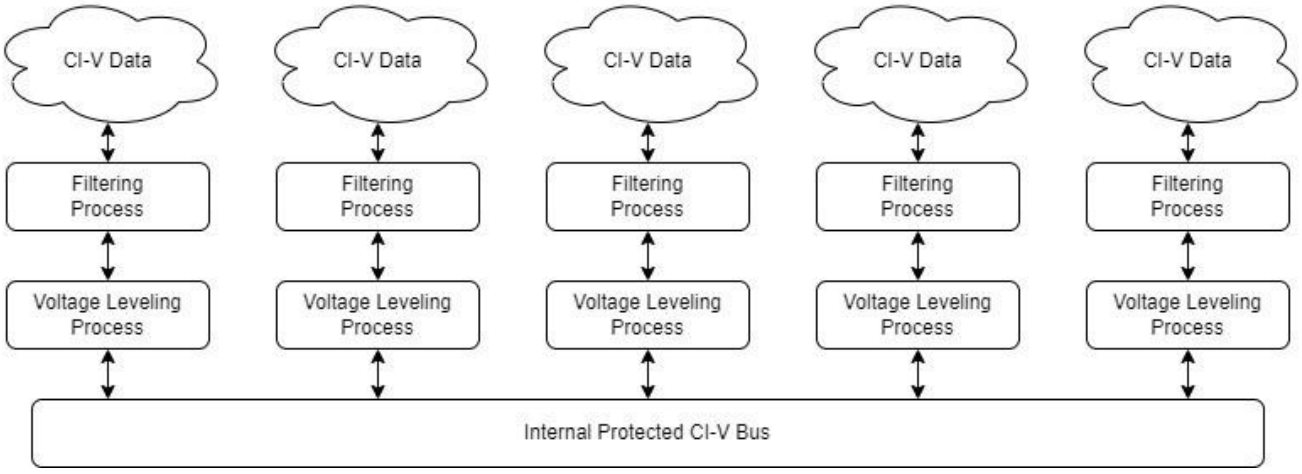


The 3.3vdc signal being so close to the trigger threshold of TTL, the resulting data is corrupted since the device decoding the TTL signal improperly recognized low level caused by the signal lost. The first pulse in this example is properly decoded by the device, the second one falls into the unknown state of the TTL standards; thus it is NOT detected, and the device thinks it is still LOW, the final pulse is so low that the device thinks this is actually a LOW pulse.

iii. TrueCIV; TrueTTL applied to CI-V.

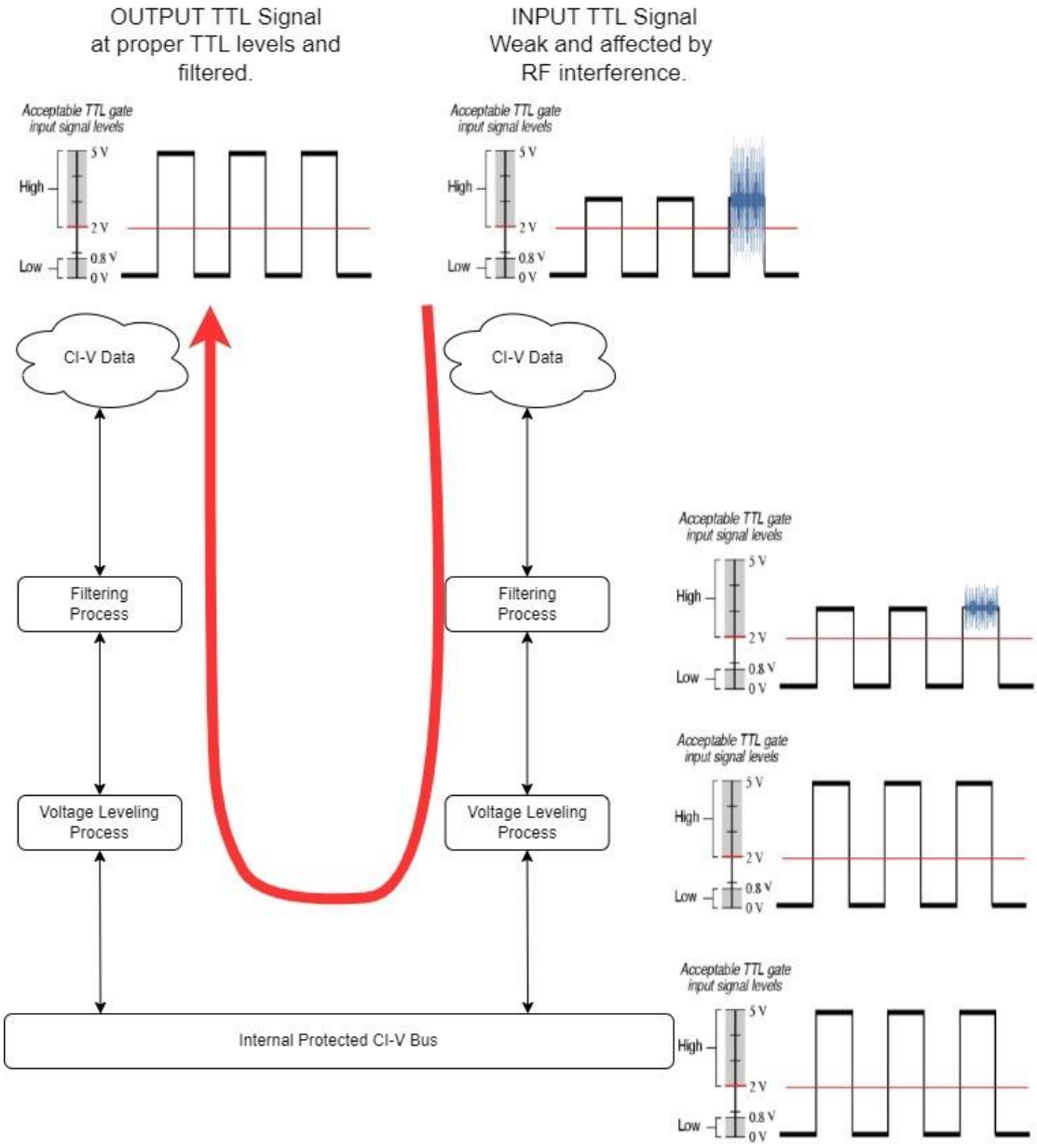
□ Real life application of TrueCIV.

In the example below, we are showing a TrueCIV implementation in a CI-V Hub environment. This design used by VE2DX ELECTRONIC DESIGN INC. In our newer generation CT17B design since July 2023, isolates every data entry point forcing each signal to go through the filtering and level correction stages of the process, both in the Input or the Output functions of these IO ports.



Via this approach if a signal is weak and/or damaged, it can be corrected before it is shared on the other ports of the hub.

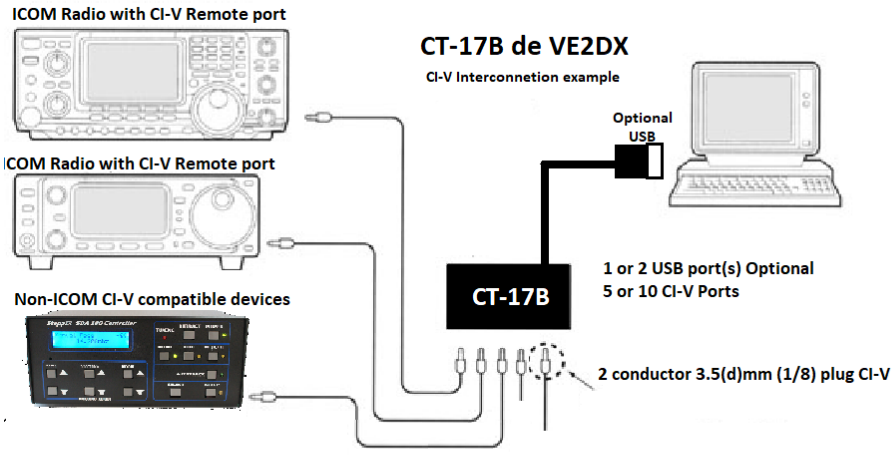
In the next image, the reception of a low level TTL signal with interferences on the third pulse is shown on the right side. As you go down the right side following the RED arrow you can see how the different stages of the TrueCIV process are first filtering down the Interferences so they are NOT viewed as data, and then converted to the Internal Common Bus to proper TTL levels, to then be shared with the other ports and the output is now free of the interference and at proper TTL levels on the rigth side.



d. CT17B 3D SLA Printed enclosures

All **VE2DX CT17B©** enclosures are designed by **VE2DX Electronics Design Inc**. And professionally 3D printed and polished for the best possible results

e. CT17B Interconnection diagram



CT-17B-5 = 5 CI-V Port
CT-17B-6USB = 5 CI-V Port and 1 USB Port
CT-17B-10 = 10 CI-V Port
(Note by removing JP1 you can split the 10 Port hub into 2 X 5 port indepedant hubs)

CT-17B-11USB = 10 CI-V Port and 1 USB Port
(Note by removing JP1 you can split the 11 Port hub into 2 X indepedant hubs (1X5 CI-V ports and 1X USB and 5 CI-V Ports)

CT-17B-12DualUSB = 10 CI-V Port and 2 USB Port
(Note by removing JP1 you can split the 12 Port hub into 2 X indepedant hubs (2 Hubs with 1X USB and 5 CI-V Ports)

4. Installation

a. CT17B© CI-V Port

Warning

Before plugging in ANY device's CI-V or USB port, you MUST ensure all equipment and power sources are turned OFF.

(Radios, Power supplies, accessories, PC, etc...)

1- Turn off all your radios, non-ICOM CI-V compatible devices, and Power supplies.

2- Plug a mono 1/8 audio cable from the ICOM REMOTE connector on the back of the radio to the **CT17B©** Hub.

3- Make sure all devices and radios are turned off; do the same from the back of all your devices to the **CT17B©**.

4- Power ON your radios and equipment and configure them per the manufacturer's recommendation.

Note:

Some devices, like the WX0B Bandmaster or the Steppir SDA-100, use special DB-9 to 1/8 audio cables and may require special cabling or option cards in the unit. See your manufacturer manual or website.

Please go to the specific section below for your CT17B© device.

i. CT17B-5 ©

5- The CT17B-5© does not require ANY power to operate. Thus, you are ready to go once your radios and devices are plugged in.

ii. CT17B-5 V2©

5- The CT17B-5 V2© DOES require USB power to operate, but it DOES NOT use the USB connection for data transfers to the PC.

iii. CT17B-6USB V2©

5- Go to device manager and locate your new Com Port.

iv. CT17B-6BT V2©

5- The CT17B-6BT V2© DOES require USB power to operate, but it DOES NOT use the USB connection for data transfers to the PC. But, the CT17B-6BT V2© can be linked to a PC using Bluetooth following these steps;

For Bluetooth see Section 4b. Windows 10 for more information.

v. CT17B-7DM V2©

5- The CT17B-7DM V2© DOES require USB power to operate. It DOES use the USB connection for data transfers to the PC.

For USB, go to device manager and locate your new Com Port.

For Bluetooth see Section 4b. Windows 10 for more information.

b. Windows 10 configuration

Warning

Before plugging in ANY devices CI-V or USB port, you MUST make certain that all equipment and power sources are turn OFF.

(Radios, Power supplies, accessories, PC, etc...)

Notes:

You MUST be a Windows 10 ADMINISTRATOR user to proceed further!

This procedure is based on Windows 10

1- Turn off all your ICOM radios, non-ICOM CI-V compatible devices and Power supply's.

2- Plug a mono 1/8 audio cable from the ICOM REMOTE connector on the back of the radio to the **CT17B** Hub.

3- Making certain all devices and radios are turned off, do the same from the back of all your devices to the **CT17B,** plugging it into the PROPER CI-V port (on most ICOM radios this is identified as REMOTE).

4- **Before plugging in your CT17B-6BT Bluetooth, you need to understand that for COMPLETE radio isolation you should NOT be using your PC USB ports to power the CT17B-6BT Bluetooth if your intent is to isolate the PC and RF of your shack via the CT17B-6BT Bluetooth link. Instead, you should be using a 12VDC to USB 5VDC low noise converter and use the station 12VDC power source or use a simple AC to USB transformer, do note that these can be RF Noisy!**

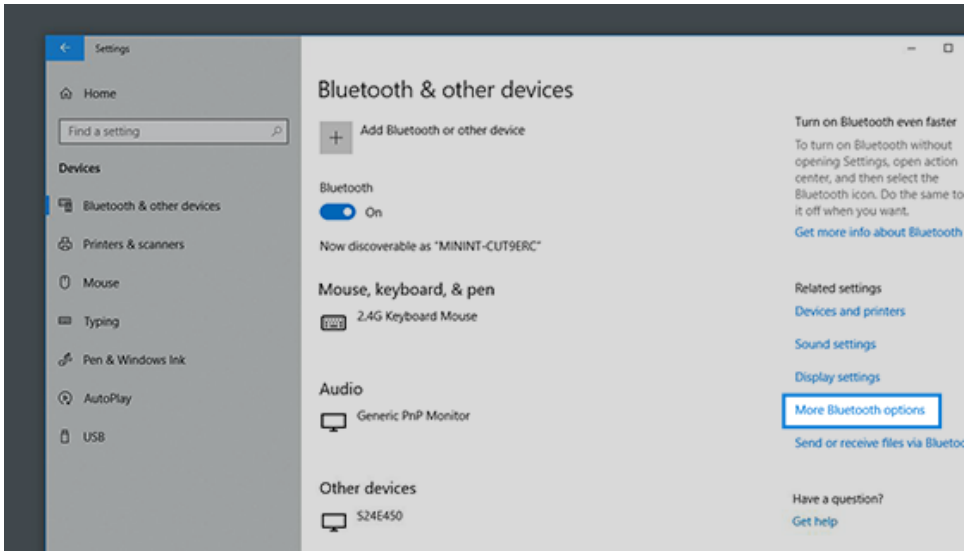
4b- Power on your CT17B-7DM.

4c- look on the CI-V port side of the CT17B-6BT you will see a BLUE PAIRING LED and a RED POWER LED. ***The* RED POWER LED *should be ON, If Not check your power source.***

Note:

There are 3 LEDs on the newer CT17B-6BT devices, the Power LED on the left of the device, The Yellow CI-V LED is in the center and the BLUE Blootooth PAIRING LED is on the LEFT side.

5- On your Windows10 command line type “BLUETOOTH”, windows 10 should offer you the Bluetooth section of the Parameters panel.



5A- Make certain the Bluetooth is ACTIVATED.

5B- Click on the + sign next to “Add Bluetooth or Other Devices”

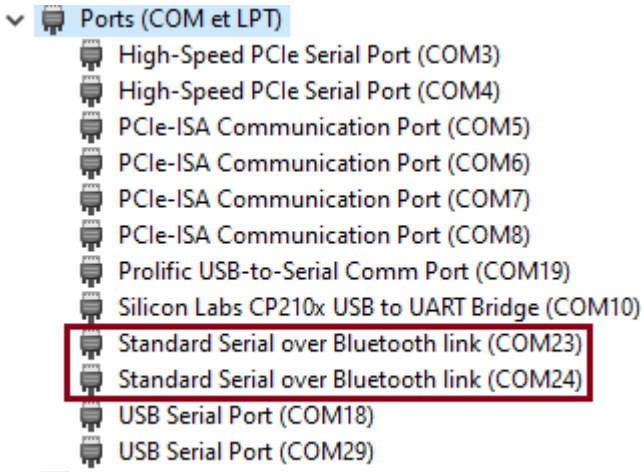
5c- on the next Black screen click on “Bluetooth”.

5d- This step can take a few minutes, you will see an unknow device come up and after a while this device will change name to “VE2DX CT17B-7DM”, select this device and PAIR with it, Windows10 will then ask for a password it is “1234”

6- Open “Control Panel” and select “device manager”

6a- In “Device Manager” expand the ”Bluetooth” section. Confirm that you see the VE2DX CT17B-7DM. ***If not go back to Section 10.***

7- In “Device Manager” expand “Ports (Com & LPT)” section



Note:

The COM Port numbers will likely be different

More advanced users can use the advanced port configuration to change the COM port ID, but you MUST ensure the selected port is not already in use.

7b- Note that all the existing Com ports and their “COM” names. you will see TWO new com ports

7c- They are identified as “Standard Serial over Bluetooth link”

Important

NOTE: Even after the CT17B-6BT is paired to the PC, the BLUE LED will still be OFF until the application in the PC is LINKED to the Bluetooth Serial port.

c. Setting up the CT17B© on an ICOM IC705

The CT17B-6BT V2 and the CT17B-7DM V2 can create virtual CI-V ports on an ICOM IC705 by linking the IC705 via Bluetooth to the CT17B-6BT V2 or CT17B-7DM V2. The following steps show how to do so.

i. CT17B-6BT V2 © or CT17B-7DM V2 ©

5- The CT17B-6BT V2 © DOES require USB power to operate, but it DOES NOT use the USB connection for data transfers to the PC, the CT17B-7DM V2 © does use the USB port for both power AND data. The can both be linked to a PC using Bluetooth following these steps;

1a- Make certain your CT17B-6BT or 7DM V2© is powered up.

1b- on the IC705, push "MENU".

1c- Select "SET".

1d- Select "BLUETOOTH".

1e- Select "PAIRING."

1f- Select "Device Search".

1g- Select' Search Data Device".

1h- Select “VE2DX CT17B-6BT (or 7DM)”

1I- Enter the PIN 1234.

1J- you are now linked. Note that the Yellow lite will show CI-V activity on the CI-V bus.

ii. 705 step by step.

Warning

Before plugging in ANY device's CI-V or USB port, you MUST ensure that all equipment and power sources are turned OFF.

(Radios, Power supplies, accessories, PC, etc...)

1- Turn off all your ICOM radios, non-ICOM CI-V compatible devices, and Power supply.

2- Plug a mono 1/8 audio cable from the ICOM REMOTE connector on the back of the radio or other OEM CI-V compatible devices into the **CT17B** Hub.

3- Make sure all devices and radios are turned off; do the same from the back of all your devices to the **CT17B**.

4- **Before plugging in your CT17B Bluetooth, you need to understand that for COMPLETE radio isolation, you should NOT use your power source as the ICOM IC-705 to power the CT17B Bluetooth. Instead, you should use any low-noise Micro-USB Power Supply; you could also use one of your PC USB ports if they are on the same ground as the other CI-V devices.**

4b- Power your CT17B using a Micro-USB cable to either a power source or a PC.

4c- look on the CI-V port side of the CT17B-6BT; you will see a red POWER LED; it should be ON. If ***Not, check your power source.***

5- Power on your ICOM IC-705.

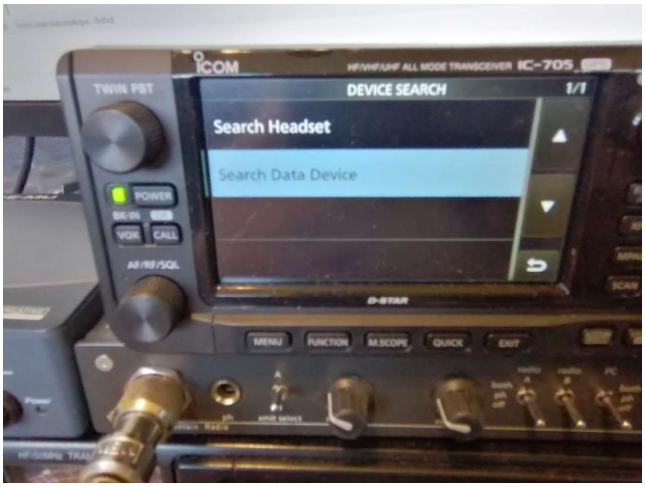
6- Press the Menu button.

7- In the menu on page 1, press the SET Button

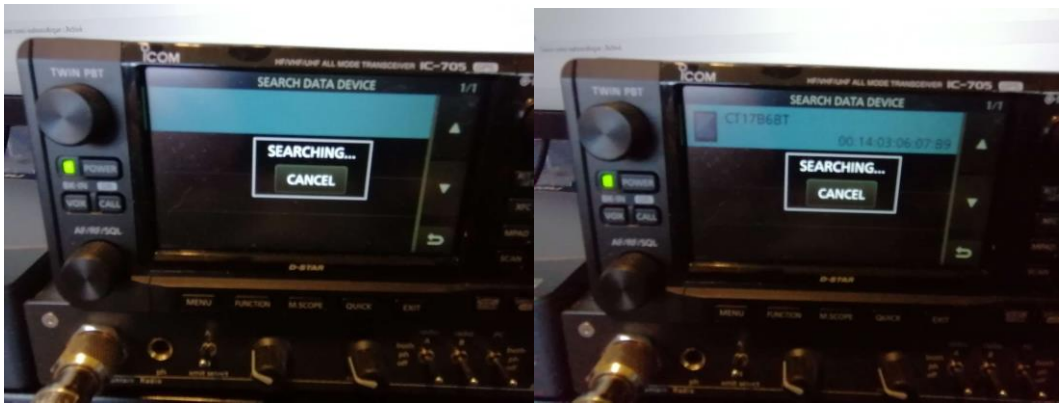
8- Locate and select the “Bluetooth Set” button.

9- Locate and select the “Pairing/Connect” button.

10- Locate and select the “Search Data Device” button.



11- After 30s to 2 minutes, you will notice that a new device ided as “VE2DX CT17B-XXX” will come up in your list.



12- Select “VE2DX CT17B-XXX” and answer yes to the “Connect?” question.

13- You will now get a message saying “Connecting...” (CT17B-6BT in this example)

14- Your following message will be to enter the “PIN Code,” hit the OK button, and enter 1234 using the on-screen keyboard (CT17B-6BT in this example)

15- the ICOM IC-705 and VE2DX CT17B-XXX will now get connected.

16- This is the resulting screen.

Notes :

Now, your Bluetooth Blue Pairing LED is ON Solid.

Some images used in this manual show examples using the CT17B-6BT. The results of the CT17B-7DM process will be the same except for identifying the device!

iii. IC-705 CI-V Configuration step by step.

We must adequately configure your IC-705 to echo the CI-V commands via the Bluetooth Data Port.

1 - Press the Menu button.

2 - In the menu on page 1, press the SET Button.

3 - In the “SET” menu, locate the “Connectors” button and press it.

3 - In the “Connectors” Menu, locate the CI-V button and press it.

4- In the “CI-V," Locate the “CI-V Transceive” button and make sure it is set to ON.

Note:

This may change based on your software or device needs.

5 - now locate the “CI-V USB Echo Back” and ensure it is set to ON.

Note:

This last step is essential to link your ICOM IC-705 to your PC applications via the IC-705 USB Port.

6 - Go back to the “SET” menu, locate and select the “Bluetooth Set” button.

7 - Locate and select the “Data Device Set” button.

8- Select the “SerialPort Function” button.

! This next step is very IMPORTANT!

9- Make sure that the “**CI-V (Echo Back OFF)**” is selected.

5. Connectors and indicators.

The different CT17Bs have variations of Connectors and indicators.

a. CT17B-5

Front: The CT17B-5 is a fundamental hub without any indicator.

Rear: There are five 3.5mm CI-V jacks. All are linked.

b. CT17B-5 V2

Front: Two indicators on the CT17B-5 V2, Power (Red) and CI-V Data (Yellow).

Rear: Five 3.5mm CI-V jacks are linked via TrueCIV, and a USB-C connector for power.

c. CT17B-6USB V2

Front: Two indicators on the CT17B-6USB V2 are Power (Red) and CI-V Data (Yellow).

Rear: Five 3.5mm CI-V jacks are linked via TrueCIV and a USB-C connector for power and DATA transfers.

d. CT17B-6BT V2

Front: There are three indicators on the CT17B-6BT V2: Power (Red), CI-V Data (Yellow), and Bluetooth connection (Blue).

Rear: Five 3.5mm CI-V jacks are linked via TrueCIV, and a USB-C connector for power.

e. CT17B-7DM V2

Front: There are three indicators on the CT17B-6BT V2: Power (Red), CI-V Data (Yellow), and Bluetooth connection (Blue).

Rear: Five 3.5mm CI-V jacks are linked via TrueCIV and a USB-C connector for power and DATA transfer.

6. Tips

1- Newer radios like the 7300, 7610, and 9700 already have a USB port used for both audio codec and CI-V communication, but they STILL have the REMOTE CI-V port on the back of the radio. Properly configured, these radios can echo their commands from their USB port back out the REMOTE port to other radios or non-ICOM CI-V devices. Your **CT17B** does not need the USB option in this situation.

2- In an advanced SDR setup using HRD and SDRUno, for example, a major limitation of SDRUno is that it is designed to use the link to the logging software (like HRD) as a Kenwood radio, limiting in a major way the functions between HRD and the radio. Suppose you have a **CT17B WITH USB** option. In that case, you can configure a SECOND radio as the NATIVE ICOM config via the USB port, thus getting more advanced functions to the radio and running at the same time the Kenwood config in HRD for the SDRUno interfacing **WORKS REAL NICE!** 😛

3- Multiple ICOM radios can run on the same CI-V Hub and be linked together using the CI-V Transceive option. If CI-V Transceive is enabled, all compatible radios (for example, HF) will be linked and change frequencies together.

4- The CI-V Transceive option often needed to be enabled on the radio for non-ICOM devices to be linked to the radio.

5- Some devices, like the WX0B bandmaster first generation, must have the CI-V address configured to match the tracked radio.

6- ID-52, ID-5100 and IC-2730, use special non standard cables for CI-V cabled connection. These have connection from Stereo Plug (Radio side) Ring to Mono (CT17B side) Mono.

⚠ IMPORTANT ⚠

7- Audio cables being used to link the CT17B hub to Radios or non-ICOM devices MUST be mono cable, not stereo. This does not make any difference in most installations, but we encountered some problems caused by stereo cables where the TTL lines were grounded. The CT17B is designed to prevent this, but not all ICOM or NON-ICOM radio or devices are.

73 De Richard VE2DX 😋