VE2DX

From CANADA (VE) 2 the WORLD (DX)

VE2DX TrueTTL, Theory and Application

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20 July 2023	VE2DX	Data acquisition and document structuring.	1.0.0 to 2.0.0
20 July 2023	VE2DX	First Draft release for editing	2.1.0
2 august 2023	VE2DX	Added TrueCAT example.	2.2.0

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o Introduction

Amateur Radio stations are often automated using CAT (Computer Aided Transceiver) interfaces.

CAT is commonly based on TTL (Transistor–transistor logic) standards, this is a 0-5vdc logic communication protocol, and the triggering thresholds are 0vdc-0.8vdc for a low and 2.2vdc-5vdc for a high. The 0.8vdc-2.2vdc zone is a no man's land.

Computer Aided Transceivers (CAT) technology are common Amateur Radio station automation architecture and protocol, this environment is filled with multiple different sources of interferences. It is important that devices and radios handling control and CAT signals be heavily shielded and filtered from this.

VE2DX Electronic Design Inc. new TrueTTL and its implementation in ICOM products as TrueCIV and other CAT environments such as TrueCAT is a series of shielding, filtering, and automatic signal level monitoring and correction processes, that cleans signals and always makes certain that the resulting signal used is at maximum TTL Level standards for best results.

In this document, we will introduce the reader to TrueTTL and its implementation as TrueCIV and TrueCAT, the principles on which it is based, and how it is being implemented in VE2DX Electronics Design Inc. designs and products.

Unless indicated otherwise, the context of this document includes their implementation in VE2DX Electronics Design Inc. Products.

Disclaimer The content contained herein is correct as of August 2023, and represents the status quo as of the time it was written. TrueTTL, TrueCAT, and TrueCIV may change going forward, as we continually improve designs for our customers.

○ Goal

The goal in this White paper is to introduce the reader to VE2DX Electronics Design Inc. new TrueTTL technology, theories, implantation, and technical aspects, and explain the implementation of TrueTTL in the CAT environment (TrueCAT) and ICOM CI-V environment (TrueCIV), and the advantages to our customers.

○ Technical information.

• Why TrueTTL?

Improper or weak TTL voltage levels are 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 levels. Even if they are within TTL specifications, the problem with these signal voltage levels is that it makes the signals more prone to interference and signal loss.

In the new generation of VE2DX 2023 products 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.

○ What are TrueTTL, TrueCIV, and TrueCAT?

• TrueTTL.

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 filtering of the incoming TTL signals from RF interferences, implementing added filtering on every power and ground connection of the design. It 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.

The process can be used in a bidirectional circuit like 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. It is than either fed to the device and/or shared on a common internal bus to be used by other IOs or devices attached to the bus,filtered and at proper 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) a clean working signal for better data processing.

- 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 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 them. This said, 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.

- 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 separated in such an environment. Thus, each signal is 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 process signals in and out of RS232c conversion on the TTL side, making certain it is clear of interferences and converted properly.

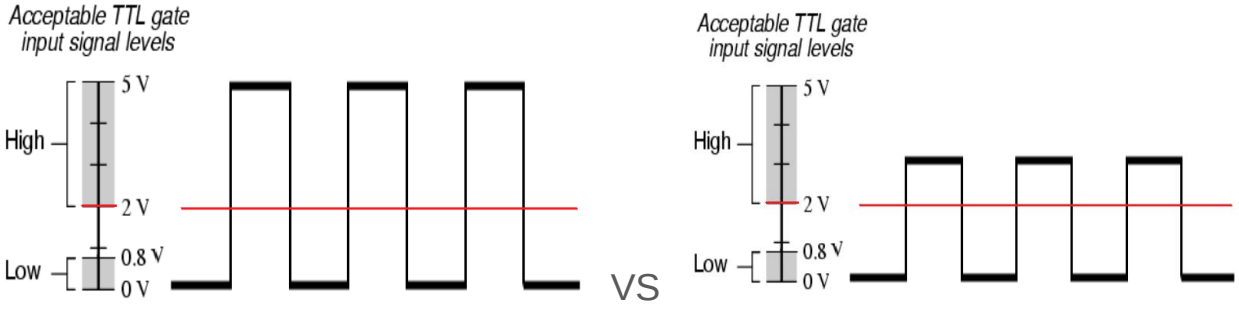
○ Why Interferences and voltage levels management?

• 5vdc vs 3.3vdc in TTL environment.

First, let's understand the principles behind TTL. TTL is a simple and very basic communication standard that can handle both 5vdc and 3.3vdc-based signals.

So why should one spend so much time making certain that all one's signals are at 5vdc if 3.3vdc is perfectly within TTL standards? Interference management, since we are using this signal in an RF environment proper RF filtration is a MUST! And proper level management helps with interference management.

The graphic below shows a normal 5vdc TTL signal vs a 3.3vdc TTL signal in reference to standardized TTL levels.

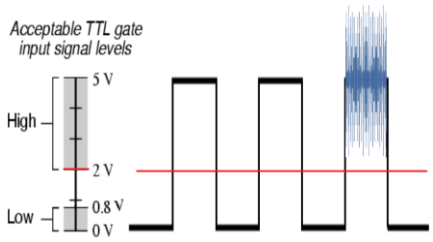


As one can see both are within standardized TTL Level, but at 3.3vdc the signal is much closer to triggering thresholds.

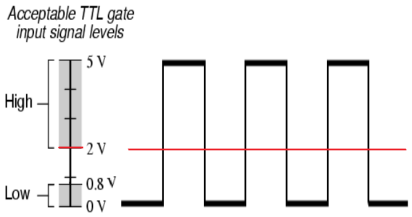
The following pages of this White Paper, will start applying both interferences and signal loss to both a 5vdc and 3.3vdc environment in order to see how they are affected.

- TTL handling of interferences.
    - *5vdc with interference in the TTL environment.*

Let's introduce some interferences in the equation on a proper 5vdc TTL signal and see the result:



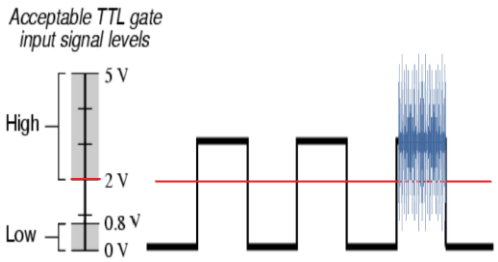
Resulting in



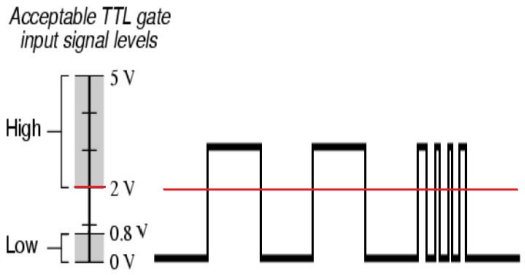
Because the TTL Levels were at 5vdc, the interference did not reach trigger thresholds of the TTL standards, and the device properly decoded the signal, thus the interferences must be larger before the TTL signal is corrupted.

- *3.3vdc with interference in TTL environment.*

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



Resulting in



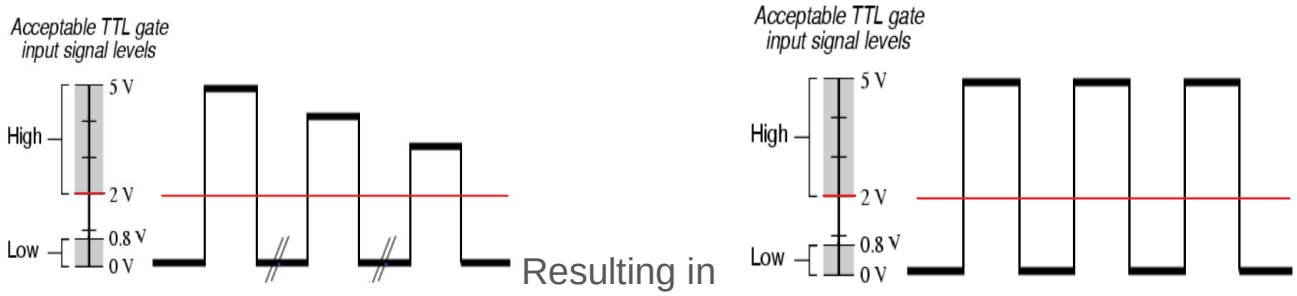
The same test with TTL levels at 3.3vdc clearly shows that multiple peaks in the interference resulted in triggers in the attached device decoding of the signal. This is because the 3.3vdc levels are closer to the trigger levels in the TTL standards, thus the data is corrupted more easily.

- TTL handling of signal lost.

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

○ 5vdc TTL handling of signal lost.

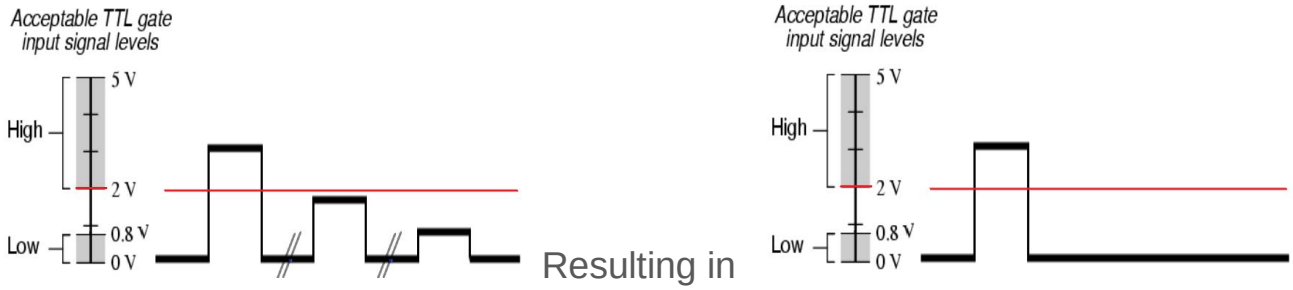
On a 5vdc TTL level signal, applying a 2vdc signal lost to the signal, the signal is still within TTL Level standards not affecting the resulting data;



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

○ 3.3vdc TTL handling of signal lost.

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



With 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 a low level caused by the signal loss. 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 a LOW pulse.

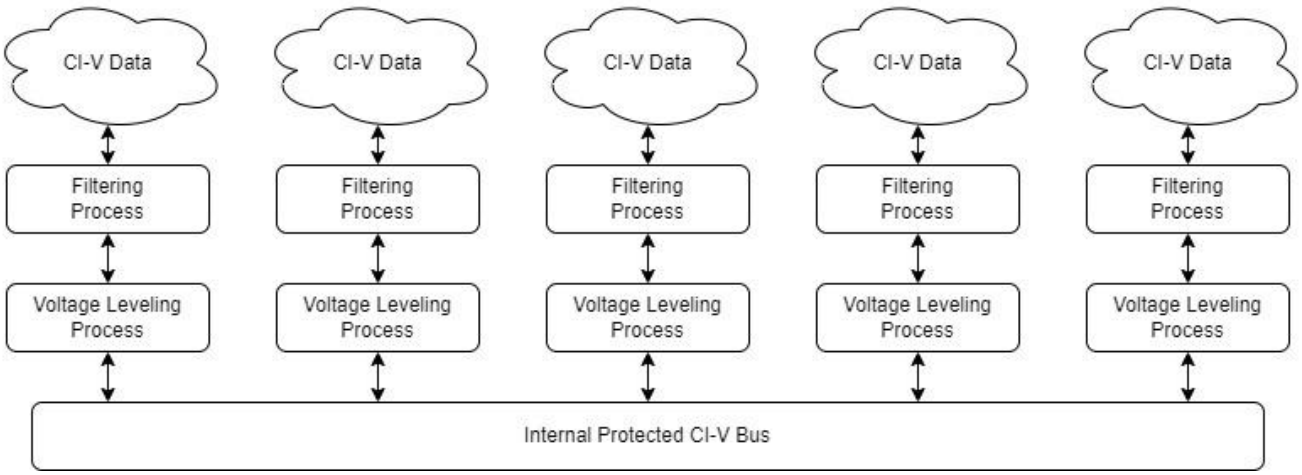
o Real-life application of TrueCIV.

Now let's apply the TrueTTL/TrueCIV design in the evolution of the VE2DX Electronics Design Inc. CT17B product group.

The CT17B product group is an evolution of ICOM hubs that were designed as a modern replacement for the ICOM CT17 technology designed in the late 70s. They are made of 4 basic elements.

- A series of CI-V ports.
- A filtering process of the CI-V signals.
- A CI-V common bus.
- And optional added interfacing like USB, Bluetooth, or USB/Bluetooth.

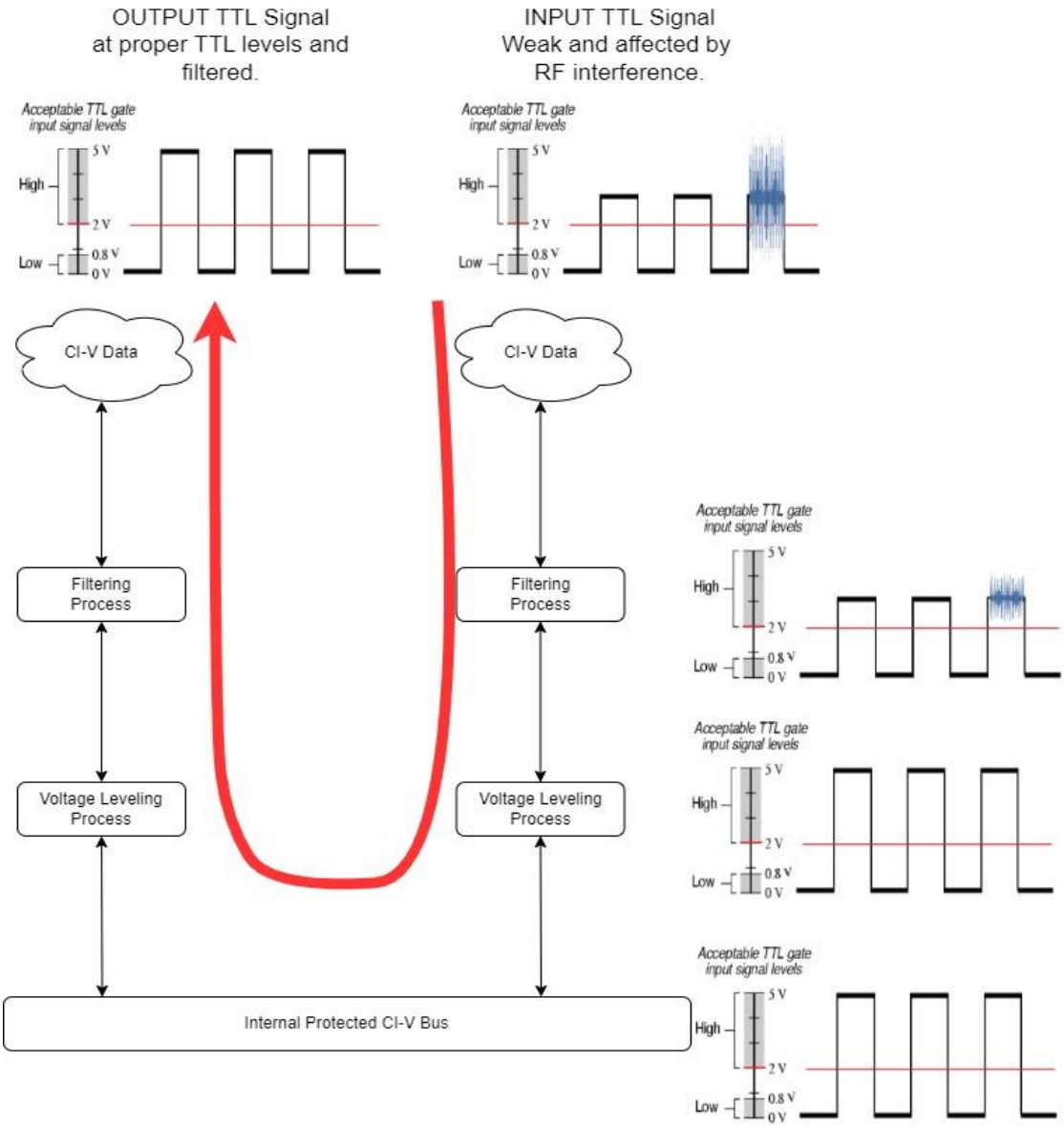
The example below, shows a TrueCIV implementation in a VE2DX CT17B CI-V Hub environment. This design is used by VE2DX ELECTRONIC DESIGN INC. The newer generation CT17B Version 2 design, since July 2023, isolates every data entry point, forcing each signal to go through the filtering and level correction stages of the process, both in the Input or the Output functions of these IO ports.



Not shown in the diagram above, is that all power sources and EVERY grounding points are also now filtered at the source.

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.

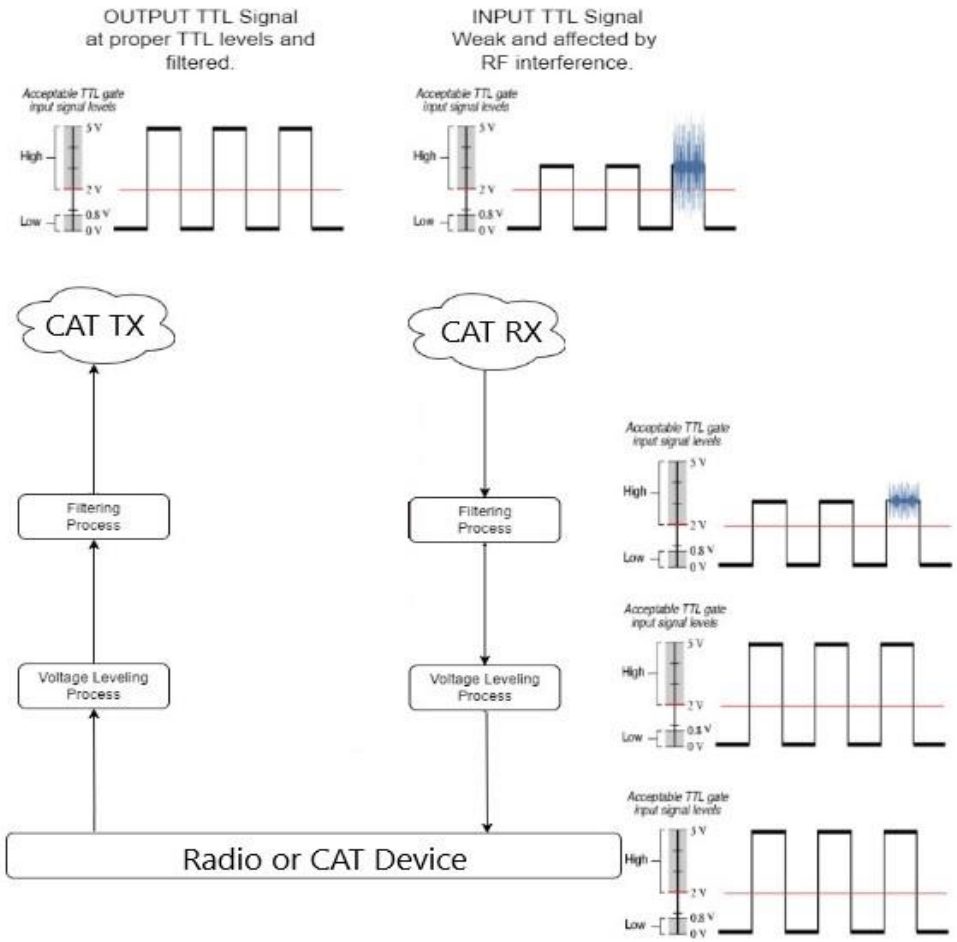
In the next diagram, the reception of a low-level TTL signal with interferences on the third pulse is shown on the right side. As one goes down the right side following the RED arrow onecan see how the different stages of the TrueCIV process are first filtering down the Interferences so they are NOT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



○ Real-life application of TrueCAT.

Applying TrueTTL to CAT communications (TrueCAT) is a lot easier than TrueCIV, since the CAT operations are made of two distinct unidirectional links, RX and TX.

Thus, we simply apply the filtration and level correction on each data link as shown below.



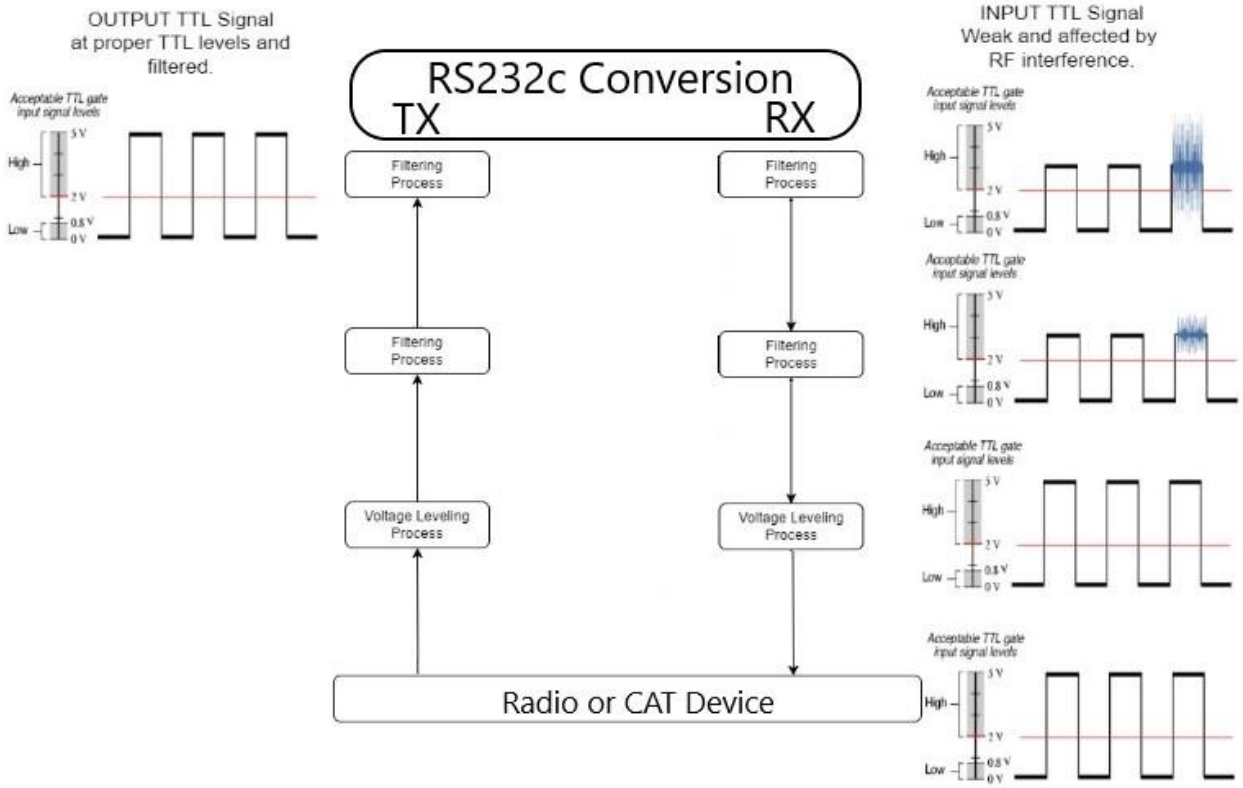
The CAT RX signal is first filtered and then TTL Level correction is applied so that any signals received below the full TTL Level of 5vdc are corrected before being applied to the radio or the CAT device.

In CAT TX Process the TrueCAT technology is still applied to prevent improper signals from the radio or the OEM CAT device, thus in this sequence, the signal is

changed to full TLL, and the signal is cleaned through a filtering stage to make certain it is 100% clean before being sent.

○ Real-life application of TrueCAT in RS232c environment.

TrueTTL can be applied to RS232c in the pre-conversion stages, where the internal TTL circuitry is both filtered and level corrected to make certain the RS232c conversion is done with the best possible TTL signals. In a similar approach to TrueCAT in a TTL environment the signals received are also filtered and level corrected to make certain the device gets maximum performance.



○ About the author

Richard G. Desaulniers Sr. VE2DX is an avid Amateur Radio operator and experimenter since the mid-'70s. First licensed in Quebec, Canada as VE2STN in

1991, he upgraded his license soon after and changed his callsign to VE2DX in 1995.

Richard was involved in local, Provincial, and National Amateur Radio Emergency Services, in such events as the 1996 Saguenay inundations, the 1997 and 1998 Quebec Ice Storms, the 2010 Haiti Earthquake, and many other minor events. He was RAQUI RUG Assistant Emergency Coordinator from 1996 to 1999 and in 1999 was named RAC Section Manager for Quebec.

Richard was also involved with Amateur Radio Manufacturers like Easy Rotor Control and Ham Radio Deluxe as a beta tester helping in the development of their products.

On the professional side, Richard worked for USA-based electronic manufacturers and service companies as International Support Specialist and for the Canadian Government as a project manager at the Montreal Port Authorities, from 1998 till 2020. After retiring in 2020, he started VE2DX Electronic Design Inc. intending to offer Amateur Radio operators a series of low-cost products to help their day-to-day operations.

○ About VE2DX Electronic Design Inc.

VE2DX Electronic Design Inc. is a privately owned Canadian-based company, incorporated in Quebec and based out of Laval, Quebec. The official contact is Richard G. Desaulniers Sr., VE2DX via email at ve2dx@hotmail.com, phone at 450-689-4591, or our website WWW.VE2DX.COM.

VE2DX Electronic Design Inc. was founded in January 2020 by Richard G. Desaulniers Sr., VE2DX, it is a pioneer in CAT and CI-V devices and other Amateur Radio station interfaces and automation.

We are proud of the out-of-the-box features of our products, like adding magnets to the bottom of our enclosures to help the user position the device where needed, RF filtering of all of our IOs and controls, advanced technologies like our High Isolation SO2R 2X6 remote antenna switch, and our newest technology introduction TrueTTL/TrueCIV/TrueCAT.

It started with:

- The introduction of the VE2DX CT17B CI-V hubs that went through multiple evolutions since the early versions.
- This included the introduction of the CT17B-6BT, a 5 port CI-V hub with Bluetooth interface, first created to help the clients in isolating the PC side of the station from the RF side, the introduction in 2021 of the IC-705 which showed a badly needed missing feature, there were no CI-V ports on the radio, this was resolved by using the CT17B-6BT as an external CI-V hub for the IC-705 using a Bluetooth link.
- VE2DX Electronic Design Inc. also offers Yaesu Bluetooth interface, SO2R 2X6 Remote antenna switch with very high isolation.
- VE2DX ICOM Meters that can support more than 23 different ICOM radios from older to newly introduced models.
- and its little brother the VE2DX ICOM HDMI Meter, basically the same radio support and functionality as the VE2DX ICOM Meters but instead of the 2inch display it interfaces using HDMI output for full HD output to any monitor.

73 De Richard VE2DX 😋