TKXEC model QH-VISG2-ED
Voltage and Current Generator

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Overview

This document is an attempt to more clearly document the features, use and configuration of the voltage and mA 'signal generator' [the TESTER] produced in China as the pseudo-brand "TKXEC" and model number QH-VISG2-ED. Note that, supposedly, the model QH-VISG2-EN is the same device but WITHOUT the necessary internal lithium battery. At the time of this writing, the only seller that seems to carry this product is Amazon, and while they identify the "TKXEC" brand, they do not note the model number, and seem to sell ONLY this version with the included battery (however, some product reviews on the Amazon listing mention customers receiving the version without the battery, but that may have been from an older product listing. Amazon lists this product as "Adjustable 4-20mA Signal Generator Current Voltage Analog Simulator 0-10V/0-22mA Signal Sources for Value Adjusting PLC Controller Panel LED Testing Calibration".

The product comes with a single sheet user's manual which is in "Chinglish" and has issues with clarity and completeness. This new manual is intended to be instead of the original manual (it is not necessary to have both manuals in order to use the Tester).

This Tester is designed to perform two functions:

1) Provide a source of accurate DC voltages in the span of -10 ~ +10 Volts, configurable to provide various portions of that overall range, e.g. 0~10V.
2) Provide a means to generate and/or regulate DC current in a "current loop" in the range of 0~22mA, configurable to various portions of that range, e.g. 4~20mA.

Both types of 'signal' are commonly used in industrial control/process control applications, and Current Loops are used for purposes including long-distance noise-free analog wiring of analog signals running between "process transmitters" and "receivers" of various kinds. Process Transmitters include versions of measuring pressure, flow, temperature, etc; while Receivers include the analog inputs of industrial control computers (e.g. PLC's, DCS's, SCADA systems), meters, chart recorders, and the control inputs or variable speed motor controllers (e.g. VFD's) and positioning valves. This Tester is able to generate the signals that would normally be coming from the Process Transmitters, for the purpose of testing the Receivers.

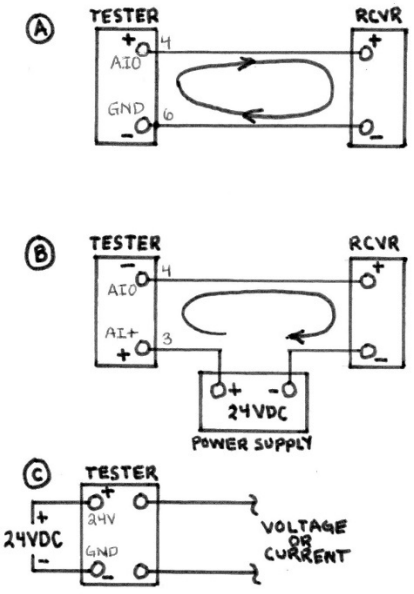
In most situations, Voltage signals are only used locally, over short wiring distances and in electrically quiet environments, whereas Current signals can be used throughout a factory or plant, over long wiring distances and through electrically noisy environments.

Connections

The Tester has a 6-position terminal block, which may be unplugged from the Tester. It uses compression boxes which are tightened by small screws, and a suitable small screwdriver is included in the box with the Tester. The compression boxes are optimal for use with stranded wires or test leads; use of solid wires is not recommended. The Tester comes with a set of six tiny pin connectors which may be soldered onto small stranded wires (22AWG or smaller size), although using them effectively turns the stranded wires into solid wires. The Tester also comes with four alligator clips and flexible insulating "boots" which you may choose to solder onto stranded wires/test leads in order to facilitate their connection to various equipment terminals or clipping onto other wiring.

For use as a generator of DC Voltages, the (+) output is on terminal position 5 (AVO) and the (-) output is on terminal position 6 (GND). When the tester is in Voltage Mode, its set voltage will appear across these two terminals.

For use as a generator of DC Current, see the following diagram and descriptions:



(A) This diagram shows how to connect the Tester (in Current Mode) to both power and modulate a mA current loop, with no other equipment besides one (or two) "Receivers" (one Receiver shown). The Tester provides power for the loop and it also modulates the amount of current according to the setting made by the user. The (+) output is taken from terminal position 4 (AIO), and the current returns on terminal position 6 (GND). Note that the Receiver's (+) connects to the Tester's (+), and likewise for their (-) connection; however, if more than one Receiver is used, the receivers are connected in series, (+) of one to (-) of the next, but the first Receiver's (+) still connects to the Tester's (+) and the last Receiver's (-) connects to the Tester's (-). This Tester arrangement is often called "Active", since the Tester is acting as both the loop Power Supply and the current transmitter.

(B) This diagram shows how to connect the Tester (in Current Mode) to modulate a mA current loop, while a separate power supply furnishes the loop power (i.e. the Tester is NOT supplying loop power). The industry standard for the separate power supply is for it to be a regulated 24VDC type, although the Tester will work with somewhat lower voltages. The Power Supply (+) connects to the Tester on terminal 3 (AI+), the Tester's terminal 4 (AIO) connects to the Receiver's (+) terminal, the Receiver's (-) terminal connects to the Power Supply (-). Although the diagram shows the components connected in this order, in fact the three 'components' may be arranged in any order within the current loop, as long as their relative +/- polarities are maintained. As with the above paragraph, if more than one Receiver is in the current loop, those must be connected in series and (+) to (-), with Power supply being the only component to have its (+) connected to the (+) of next thing in the loop, and likewise with its (-).

This Tester arrangement is often called "Passive", since the Tester is not supplying loop power and is 'only' modulating the loop current. The "Passive" and "Active" terminology is, frankly, stupid and an unfortunate convention, since it misrepresents what is going on and thus misleads people. Still, it has to be mentioned.

The Tester connection for this part of the diagram is equivalent to what would normally be referred to as a "2-wire" transmitter, although that is not a perfect correlation, because a true 2-wire transmitter derives its own operating power from the loop and does not use any other source of power, while this Tester, in this configuration, does NOT get its operating power from the loop and instead uses its own power source (its battery), yet it only connects via two wires. See section (C) below.

(C) The Tester may get its operating power from a 5VDC power source via its USB port. If the Tester is not equipped with a battery and/or the battery is installed but has a low charge and/or if there is no USB power source available and/or you simply want to power the Tester from a different power source (especially for long-term use), then an external 24VDC power supply may be connected as the Tester's operating power source. The power supply is connected as shown in section (C) of the above diagram, with the supply's (+) connected to the Tester's terminal position 2 (24V) and its (-) connected to the Tester's terminal position 1 (GND); the terminal numbers for these two positions are not shown in the diagram.

Note that BOTH of the GND terminals, positions 1 & 6, are internally connected together and thus are electrically common.

The external power supply may be used for Voltage Mode or any of the Current Mode configurations.

If the Tester is in Current Mode and connected to the loop as shown in section (A) of the diagram, AND external power is applied to the Tester per section (C) [with the Battery switch OFF], then this corresponds to what is normally referred to as a "4-wire" transmitter.

If the Tester is in Current Mode and connected to the loop as shown in section (B) of the diagram, AND external power is applied to the Tester per section (C) [with the Battery switch OFF], then this corresponds to what is normally referred to as a "3-wire" transmitter. In this configuration, if ONLY the loop power supply is turned ON (Tester power supply OFF), the loop is 'dead' and the Tester cannot derive its operating power from the loop. If ONLY the Tester power supply is turned ON (loop power supply OFF), the Tester will be active but the loop itself will still be 'dead', not controllable from the Tester. ONLY when BOTH power supplies are ON can the Tester and the loop function normally in this arrangement.

Tester Power

The tester can get its internal operating power from any of three power sources:

- Battery
    - The Tester (must be the QH-VISG2-ED model, or otherwise the QH-VISG2-EN model with a user-installed battery) has an internal battery; it is a Lithium-Ion type, 3.7V, 1000mAh capacity. 4 hours to fully charge Battery, 5 hours maximum Tester operation from a fully charged Battery.
    - The Battery is only connected when the Battery switch on the Tester is in its ON position.
    - A single multi-color "Battery" LED provides charge/charging status.
        - When the Battery is charging, the LED will flash slowly.
        - When the Battery is being used to power the Tester, and it has more than 80% charge remaining, the LED will be steady Green.
        - When the Battery is between 40% and 80% charge, the LED will be steady Yellow/Amber.
        - When the battery is lower than 40% charge, the LED will be steady Red.
        - When the Tester is operating from an external power source, the LED will probably be steady Green, but empirical testing suggests that there are some power combinations where the Tester will be ON while the LED or OFF entirely.
    - Pressing the MODE pushbutton for 1 second will cause the LED Display to show the Battery voltage for about 5 seconds.

- The Tester may be powered from a 5VDC USB power source, via the Tester's micro-USB port. A mobile-phone charger is one example of a suitable USB power source, although the charger must have a Micro-USB type plug.
    - The Battery switch should be OFF.
    - The USB power source will power the Tester's internal circuits AND will charge the Battery, using its integral battery management circuit.
    - 200mA are drawn from the USB power supply when the Battery is not charging, and 800mA (0.8A) is drawn while the Battery is charging.
    - Most modern USB chargers/wall-warts/power supplies furnish at least 1A, and this is more than the Tester requires to operate and charge the Battery.
- The Tester may be powered from an external regulated 24VDC power supply, connected via the tester's terminal positions 2 (24V) and 1 (GND); the power supply (+) side must connect to the terminal position 2 (24V), (-) side to terminal 1 (GND).
    - According to the Tester specifications, the Battery charging will work even if the external power supply voltage is as low as 15VDC.
    - The Tester consumes 1W from the external supply when the Battery is not charging, and it draws 4W while the Battery is charging. For a 24VDC external power supply, this equates to drawing 42mA when not charging the Battery and 167mA when charging the Battery.
- The Tester, when in Current Mode, cannot derive its operating power from the mA current loop; in that sense, it is not a true "2-wire" transmitter. If for no other technical reason, the fact that the Tester uses a 4-digit LED display probably puts its current consumption above the 4mA maximum power that can be derived from the loop in true "2-wire" transmitter configuration.

Indicators and Displays

The Tester has three (3) discrete LEDs and a 4-digit 7-segment LED Display:

- The Battery LED indicates the charge status and also when the Battery is being charged.
- The Voltage LED lights RED to indicate when the Tester is in Voltage Mode.
- The Current LED lights RED to indicate when the Tester is in Current Mode.
- The LED Display shows settings, presets, menu options, programmed parameters, etc.

Controls

The tester has four (4) user controls:

- Battery switch engages the internal Battery when in the ON position. When OFF, the Tester will require one of the external power sources in order to operate. It cannot derive operating power from a mA current loop.

- Mode Pushbutton; press and release quickly to toggle between Voltage Mode and Current Mode. Press for 1 second to briefly display the Battery voltage. Press for 3 seconds to enter the Menu structure.
- Knob (turned); this is a rotary encoder, not a potentiometer (although it somewhat behaves as a multi-turn potentiometer in some of its modes of use), and it has no limit to how many times it can be turned in either direction, clockwise or counter-clockwise. Turning the knob can variously change the Voltage or Current setting, or enter the so-called "Passwords", or operate the menus, or select from options in some parameters, or define presets in other parameters.
- Knob (pressed/clicked); this is a momentary pushbutton, and works as "OK", "Enter", "Confirm", "Select", etc; depending on what the Knob (turned) is being used for at the moment. Click while Tester is actively operating to SAVE the currently displayed Voltage or Current setting so that the Tester will default to that same setting the next time it is turned on; the display will show ". . ." while the setting is being saved.

Technical Specifications

- Working environment: 0~40°C (32~104°F), Relative Humidity < 80%.
- External connections (via the 6-position terminal block) are protected against most accidental mis-connections, reversed voltages up to 24V, etc.
- Size (case only): 100 x 60 x 20mm
- Size (counting Case plus the Battery switch, 6-position terminal block and Knob): 112 x 60 x 35mm (4.41 x 2.36 x 1.38")
- Weight: 96g (3.4oz)
- Maximum Output Voltage Span: -10V ~ +10V (maximum 20mA load current)
- Maximum Output Current Span: 0 ~ 22mA
- Maximum current loop resistance: approx. 500 Ohms (can accommodate two conventional 250 Ohm "Receivers" in the loop)
- Worst case Voltage Mode output error: < 0.05V
- Worst case Current Mode output error: < 0.05mA
- Voltage Mode spans: -10~+10V, -5~+5V, 0~10V, 2~10V, 0~5V, 1~5V, 0~3.3V, 0~2.5V, 0~1V, -10~0V
- Current Mode spans: 0~20mA, 4~20mA, 0~22mA
- Voltage Mode Setting Units: Real Voltage (V), 0~100% of selected span, 0~50Hz (there is no 0~60Hz option), 0~1500
- Current Mode Setting Units: Real Current (mA), 0~100% of selected span, 0~50Hz, (there is no 0~60Hz option)

In the above, the 0~50Hz option does NOT mean that the Tester output is an AC signal, rather it is simply a convenient set of units to be in when using the Voltage or Current signals to control the speed of a Variable Frequency (motor) Drive (VFD), since now the selected span can be correlated to the VFD output frequency.

Accessing the Menu

To change any mode, setting or parameter (other than simply using the MODE pushbutton to select between Voltage and Current Modes), it is necessary to access the Menu structure. The Tester requires that a so-called “password” scheme be used, in order to view and modify any of the many parameters that configure the fine points of the operation.

Note that, at any time while the display is in Menu/Parameter mode, if the user does nothing for about 10 seconds, the Tester will leave the Menu/Parameter mode and return to normal operation. Note that that the Tester’s output does not change while in the Menu/Parameter mode, it just keeps on outputting and displaying whatever it was doing before entering the Menu/Parameter mode. The 10 second period seems quite short when you are first getting familiar with the Menu scheme, so probably you will find it necessary to repeatedly re-enter the Menu mode after it ‘times-out’ as you are trying to figure out what to do next. It can help to write out the steps and parameters, in order, that you want to change or set, so that you can proceed without the time-out.

At any time while the Tester is powered ON and the display is working, the user can press the Knob in for about 3 seconds, until the display reads “F001”. This is an invitation for you to enter the Menu “Password”, which as actually just a pattern of “+” and “-“ symbols on the 4-digit LED display. With “F001” displayed, turn the Knob one detent/click clockwise, and the display will change to show “_ _ _ _”. Now, you will turn the Knob one (and ONLY one....be careful) detent/click to clockwise or counter-clockwise; clockwise will give the first (left-most) display digit a “+” (actually looks like the left half a “+”), while counter-clockwise will give a “-“. As soon as you have selected “+” or “-“ for a display position, the active display position will move to the right. Repeat the single Knob detent/click for each of the other display positions. The desired Password display pattern for MOST Menu parameters is “+ - - +“, while the Menu parameters associated with the “Point Mode” require using the Password pattern “+ - + -“.

Once all four of the Password display positions have been set, press/click the Knob once, and the display will show one of the parameter numbers, e.g. “F002” (for “+ - - +”) or “F100” (for “+ - + -“).

At this point. Rotate the Knob to scroll through the available parameters. Note that the number of parameters and the actual parameter numbers will differ depending on the setting of other parameters (particularly parameter F100), and which MODE the Tester is currently in, Voltage or Current. Also, even though the same parameter numbers are used for both Voltage and Current Mode parameter menus, many of them will have different options depending on the MODE, and indeed each MODE has its own set of similarly numbered parameters (this is indeed confusing). If you find that there don’t seem to be enough parameters, or if the number of options for a given parameter don’t see correct, the reason is probably that some other parameter has been set such that it rules out the other parameter option(s) you are looking at, especially if parameter F100 is set to certain values. Note that parameter F100 can only be accessed after entering the Password “+ - + -“, even though it affects parameters accessed through the Password + - - +.

Here are a few photos showing the Tester's display during entry of the Passwords:

Basic Password

The Knob has been pressed for 3 seconds


The Knob has been turned one detent/click clockwise

The Knob has been turned as required to get the "+ - - +" Password

The Knob has been pressed/clicked, "F002" displayed

Advanced Password on next page.....

Advanced Password

(for access to Point Mode parameters)

The Knob has been pressed for 3 seconds, “F001” displayed

The Knob has been turned one detent/click clockwise

The Knob has been turned as required to get the “+ - + -” Password

The Knob has been pressed/clicked, “F100” displayed

The Parameters are listed on the next page.....

Parameters for VOLTAGE MODE (tester MUST be in Voltage Mode first)			
Parameter	**Description**	**Note**	**Default**
F001	Adjust Mode	0: Coarse (0.X) 1: Fine (0.0X) 2: Point Mode (first set F100 > 0)	0
F002	Output Span	0: -10~0~+10V 1: -5~0~+5V 2: 0~10V 3: 2~10V 4: 0~5V 5: 1~5V 6: 0~3.3V 7: 0~2.5V 8: 0~1V 9: -10~0V	2
F003	Display Units	0: Real Voltage 1: 0~100.0% 2: 0~50Hz 3: 0~1500	0
F004	Incr/Decr 0.X	1~50; this X10 is the amount the setting will change for each detent/click while turning the Knob to adjust the Setting (while ignoring the decimal point)	1
F005	Incr/Decr 0.0X	1~50; this X1 is the amount the setting will change for each detent/click while turning the Knob to adjust the Setting (while ignoring the decimal point)	1
F006	-10V Cal. Value	-999 ~ +999 *	
F007	0V Cal Value	-999 ~ +999 *	
F008	+10V Cal. Value	-999 ~ +999 *	
F100	Point Mode Qty	0: Point Mode ** disabled 2~9: How many points in Point Mode	0
F101~109	Point Mode Values	Set any value between -10~+10V for each of the points defined by F100	

* These are internal references, and should not usually need to be changed (they were set at the factory during calibration). Keep in mind that the Tester is only designed to be accurate to an error of no greater than 0.05V, so if the accuracy is no worse than that, changing these three parameters will not help. Before changing these three parameters, take note of what their 'Factory'values were, so you can set them back as might be necessary.

** "Point Mode", instead of requiring the user to turn the Knob many times to select a setting within the entire programmed Voltage span, instead allows the user to turn the knob just a few detents/clicks to select from a few pre-defined Voltages (between as few as two Voltages and as many as nine Voltages); these are called "Points". To use this mode, first change parameter F100 to a value of '2'. This should result in parameter F001 being allowed to be changed to a value of 2~9, specifying the desired number of Points. Then, the additional parameters F101, etc; will become accessible (more or less of them depending on the number of Points); for each of these parameters, use the Knob to select the desired Voltage for that Point.

When all parameters have been adjusted as needed, turn the knob clockwise, scrolling through the accessible parameters until the display reads "FEnd", meaning the end of the available parameters. Press/click the Knob to save the parameters and exit the Menu (or just wait for 10 seconds).

Parameters for CURRENT MODE (tester MUST be in Current Mode first)			
Parameter	**Description**	**Note**	**Default**
F001	Adjust Mode	0: Coarse (0.X) 1: Fine (0.0X) 2: Point Mode (first set F100 > 0)	0
F002	Output Span	0: 0~20mA 1: 4~20mA 2: 0~22mA	0
F003	Display Units	0: Real Current (mA) 1: 0~100.0% 2: 0~50Hz	0
F004	Incr/Decr 0.X	1~50; this X10 is the amount the setting will change for each detent/click while turning the Knob to adjust the Setting (while ignoring the decimal point)	1
F005	Incr/Decr 0.0X	1~50; this X1 is the amount the setting will change for each detent/click while turning the Knob to adjust the Setting (while ignoring the decimal point)	1
F006	4mA Cal. Value	-999 ~ +999 *	
F007	12mA Cal Value	-999 ~ +999 *	
F008	20mA Cal. Value	-999 ~ +999 *	
F100	Point Mode Qty	0: Point Mode ** disabled 2~9: How many points in Point Mode	0
F101~109	Point Mode Values	Set any value between 0~22mA for each of the points defined by F100	

* These are internal references, and should not usually need to be changed (they were set at the factory during calibration). Keep in mind that the Tester is only designed to be accurate to an error of no greater than 0.05mA, so if the accuracy is no worse than that, changing these three parameters will not help. Before changing these three parameters, take note of what their 'Factory'values were, so you can set them back as might be necessary.

** "Point Mode", instead of requiring the user to turn the Knob many times to select a setting within the entire programmed Voltage span, instead allows the user to turn the knob just a few detents/clicks to select from a few pre-defined Voltages (between as few as two Voltages and as many as nine Voltages); these are called "Points". To use this mode, first change parameter F100 to a value of '2'. This should result in parameter F001 being allowed to be changed to a value of 2~9, specifying the desired number of Points. Then, the additional parameters F101, etc; will become accessible (more or less of them depending on the number of Points); for each of these parameters, use the Knob to select the desired Voltage for that Point.

When all parameters have been adjusted as needed, turn the knob clockwise, scrolling through the accessible parameters until the display reads "FEnd", meaning the end of the available parameters. Press/click the Knob to save the parameters and exit the Menu (or just wait for 10 seconds).

>>>> Note that, while the same parameter numbers are used for BOTH Voltage and Current modes, they are actually distinct sets of parameters for each MODE.

More notes on setting parameters:

- When a parameter is selected and the display shows the parameter number, e.g. “F102”, press/click the Knob once to display the setting value for that parameter, then turn the Knob as required until the desired value has been selected, then press/click the Knob again to return to the parameter list. The Tester will automatically increment to the next parameter number, but you can turn the Knob to skip forward or backwards through the list of parameters as desired.
- As previously noted above, you might find that not all parameters listed above are actually accessible on your Tester. This will be because some other parameter has been set to a value that makes some other parameter(s) inapplicable, and thus inaccessible. Review the notes in the parameter table to try and determine where the problem is coming from, if indeed it IS a problem, then change the parameters as might be required to make the desired parameters accessible.
- When setting values for Point Mode, the other parameters in regard to Coarse/Fine, Span, etc; will influence these special settings, although in this mode spans are always -10~+10V or 0~22mA.
- If it seems that a changed parameter has not taken effect while in the Menu, try exiting the Menu and re-entering the Menu.
- When you are done with a Menu, you can just wait for 10 seconds, and the Tester will automatically exit the Menu and return to normal operation. However, the manufacturer recommends that, to exit more quickly and also to make sure that all the parameter changes are properly saved, that you just turn the Knob clockwise to index through the parameters to the highest numbered one, then turn one detent/click further clockwise to display “FEnd”, then press/click the Knob to save and exit the Menu.
- “Coarse” and “Fine” refers to the amount of change to a Setting that will take place for each detent/click while turning the Knob. You can use parameter F001 to select Coarse or Fine, then use F004 to specify the how much the first decimal position (i.e. Coarse) of the Setting value will change for each Knob rotation detent/click (the amount can range from 1 to 50), and likewise use F005 to specify the amount of change to the second decimal position (i.e. Fine) the Setting value will be changed. If, even in the Coarse mode, you find that too many knob rotations are required, consider using Point Mode instead.
- The Tester’s manufacturer uses some different terms that what are used in this document; these are listed below in the format (Manufacturer / This Document):
    - Output Mode / Output Span
    - Display Mode / Display Units
    - Coarse / Coarse (0.X)
    - Fine / Coarse (0.0X)
    - Add or Sub Num for Knob’s Pulse (Coarse) / Incr/Decr 0.X
    - Add or Sub Num for Knob’s Pulse (Fine) / Incr/Decr 0.0X
    - Point Mode Num / Point Mode Qty
    - Point Output Value / Point Mode Values