ET-CNT6P3 (Digital Counter 6 Digit)

ET-CNT6P3 is multi-purpose Digital Counter 6-Digit that is controlled by Microcontroller and uses 5mm. Super-Bright LED that is arranged as numeric 7-Segment Display with 3.5 inch height. So, it can be visibly seen for 50m long distance. The part of Input of Counter designs signal Input Counter and Reset Counter separately by using Opto-Isolate Circuit to divide Input Circuit from Controller Circuit completely. It can be connected with Signal Input that is Contact Switch or Open-Collector and Signal Voltage (+12V Signal Pulse), so it can be connected with Input for long distance without any problem. Moreover, there is Backup Circuit that can be Backup the counting value more than 2 years although turning off for a long time.

This device consists of 3 sets of 6 Digit Screen Display to display value of Target, Actual and Difference respectively. Moreover, the screen display can be additionally expanded in many dots (not higher than 32 dots totally) by using ET-CNT6 (single version). It will be connected together to display results for maximum distance about 1.2 kilometers.

Furthermore, there is Option components that can be used additionally and it makes the operation of system more perfect. For example, ET-MC16 (16 Input Multi-Counter) that supports operation of system if a Counter counts more than one signal Input simultaneously. In this case, we can connect maximum 16 Input with ET-MC16 in the same time and then connect Output of ET-MC16 with Input of Counter again.

Application of ET-CNT6P3 in MODE-1(Digital Counter Mode)

Digital Counter Mode is Programming Counter Mode that can program the many types of counting value for Counter to correspond with requirements in each application suitably. It can program many functions of Counter as follows;

- Program initial value for counting of Counter (Preset Counter)
- Program target value for counting of Counter (Target Counter)
- Program divided value (Prescale Counter) for counting value into group; for example, Counter counts up to 1 when there are Input values that have already occurred 12 times (counting value as dozen).
- Program type of Signal Input to use with Input Counter, it is either Signal Voltage (+12V Signal Pulse) or Contact Input or Open-Collector. In this case, user can program Debounce Time if using with Contact Input.
- Program Alarm corresponding with counting value of target. Set Output of Alarm to be a Relay Contact 10A/250VAC (NO-COMMON-NC). The feature of Alarm can be configured to be many types; for example, if it reaches the required Target, Alarm automatically Reset Counter; or if it reaches the required Target, hold Alarm for a while until Reset Counter starts counting the new value.
- Program to count up (000000-999999) or count down (999999-000000).

How to Setup ET-CNT6P3 to run in Counter Mode by ET-KEY232

We can use ET-KEY232 to setup operation mode of ET-CNT6P3; in this case, we connect ET-KEY232 with ET-CNT6P3 through DB9 Connector. The method to setup values is described below;

2.1 Turn off ET-CNT6P3 by POWER Switch, connect DB9 Cable of ET-KEY232 with DB9 Female Connector of ET-CNT6P3, and then turn on POWER Switch of ET-CNT6P3. It makes ET-CNT6P3 and ET-KEY232 start operating simultaneously.

2.2 Press Key SET/RUN to enter Setup Mode and the screen of ET-CNT6P3 will display the result of the selected original operation mode as “[M][o][D][E][-][?]”

In this step, press key number 1 to set it as Digital Counter; or if the screen has already been displayed result as “[M][o][D][E][-][1]”, can press key ENT to skip over to the next step instantly.

2.3 After we have already selected operation mode to be Mode 1 (Counter Mode) completely, ET-CNT6P3 will enter the procedure of setting Preset value and the screen will display the result as “[P][r][E][S][E][t]”. The meaning of this Preset value is the initial value that Counter will start counting. Every time we set the Reset Counter, the initial value of counting will always be equal to this Preset value. Normally, if we set Counter as Counts Up, it always configures this Preset value as zero because it sets Counter start counting up from 000000-999999; on the other hand, if we set Counter as Count Down, we may set it as “999999” instead to start counting down from 999999-000000.

When the screen shows result as “[P][r][E][S][E][t]”, press key ENT to enter the procedure of setting Preset value. In this case, the screen will be changed to display the original 6 digits Preset value. In this step, we can edit 6 digits Preset value in the range of 000000-999999 as required; or if we keys wrong value, can press key CLR to delete it and then key the new value until it is correct as required. When we get the required values, press key ENT to save the Preset value in the memory. When it has already saved the value, it will skip over to

the next step immediately; however, user can return to the previous step by pressing key Esc.

2.4 After we have already set the Preset value, it will enter the procedure of setting Target value and the screen will display result as “[t][A][r][G][E][t]”. The meaning of is Target value is the target of counting or the destination of counting. Normally, if using Counter as Counting Up, we must always set Target value higher than Preset value. Moreover, It always sets Target value in 6 digits follow the required target; however, if user does not want to set the certain Target for counting, please set it as “999999” that is maximum value. If using the Counter as Count Down, it always sets the Target value less than the Preset value. Normally, we always set it to be zero when using Counter as Count Down.

When the screen displays result as “[t][A][r][G][E][t]”, press key ENT to enter the procedure of setting Target value. The screen will be changed to display the original 6 digits Target value. In this step, we can edit the values as required and we can set the 6 digits Target value in the range of 000000-999999. However, if we key the wrong value, press key CLR to delete it and then key the new value until getting the required value and finally, press key ENT to save the Target value in the memory. It will skip over to the next step immediately when it has already saved; however, user can press key Esc to return to the previous step.

2.5 After we have already set Target value, it will enter to the procedure of setting Prescale value and the screen will display result as “[P][r][E][C][n][t]”. The meaning of this Prescale value is the amount of dividing the signal counting. Normally, if using the common Counter, the value of this Prescale will be set as 0; it means that Counter will only count the amount of signal Input that exactly happens. If we want to set the counting result of Counter in the form of group, we can set Prescale value as required. If we set the Prescale value higher than zero, the counting value of Counter will start counting value when there is signal Input equal to the required Prescale value. In this case, the counting result of Counter that is displayed does not correspond with the true Input value. If we want to know the exact amount, must multiply the result that is displayed on the screen and the Prescale value together. For example, if we want to set Counter to count value as

a set of twelve or a dozen, must set Prescale value as 12; so, when signal Input happens 12 times, it makes Counter increase a value (1-dozen). If the screen of Counter displays value as 5, it means that there are signals that exactly happen between 60-71 times. Due to Counter can not display its remainder that is divided by 12; however this remainder will always be stored inside Counter although ET-CNT6P3 is turned off. There is only one way to clear the Counter value and remainder is to Reset Counter to start the new operation again.

When the screen displays result as "[P][r][E][C][n][t]", press key ENT to enter the procedure of setting Prescale value and the screen will be changed to display the original 6 digits Prescale value. In this step, we can edit the Prescale value as required by setting it into 6 digits between 000000-999999. If we key the wrong value, can press key CLR to delete it and then key the new value and finally, press key ENT to save the Prescale in the memory of ET-CNT6P3 after getting the desired values.

When it has already been saved, it will skip over to the next step instantly; however, we can press key Esc to return to the previous step.

2.6 After we have already set Prescale value, it will enter to the procedure of setting Debounce value and the screen will display result as "[d][l][Y][-][?][?]". The meaning of this Debounce value is the time delay to check the operation of signal Contact Input. Normally, while any Contact Switch is closing (Short) or opening (Open), signal on the contact jerks sharply called Bounce. The feature of Bounce is the same as the status of rapidly alternating close and open many time in the short time (about 1-10mS) before the contact exactly opens or closes. In this case, it uses Microcontroller that can be run with many million commands within 1 second to check signal Input of ET-CNT6P3; so, if Bounce happens on the contact, it makes Microcontroller find that the operation of Input happens many times for only one running the contact and it also makes the counting wrong. So, if using with signal Contact Input, it is necessary to set time delay to solve the problem of Bounce called Debounce. When it found the operation of Signal Contact Input in the first time, it does not accept the operating result immediately, but it uses time delay a moment that is equal to Debounce Time first and then check again whether the contact still works or not.

If the contact still works, it means that it is the exact operation of the contact, so it continues counting value for Counter; on the other hand, if the contact does not work after using time delay of Debounce Time, it means that the Bounce of the contact happens and it is not mentioned.

We can configure the Debounce value to be numeric 2 digits from 00 to 99 in the unit of milliSec. If using ET-CNT6P3 with Signal +12V Plus Input, we must set Debounce value to be zero; on the other hand, if using with Contact Input, we must set Debounce value in the range of 01-10 depend on the quality of the contact or may set it as 05 mS. If using with Contact Input, we should set the operation time of contact for a long time at least 3 times of Debounce Time. For example, if we set Debounce value to be 05mS, must set the operation time of the contact at least 15-20mS in each time. In this case, it is very important to select type of Input; so, if it is necessary to use Counter to count amount of Input that is very high frequency, it is better if using Signal Input Open-Collector or +12V Pulse.

When the screen displays result as “[d][l][Y][-][?][?]”, press key number 0-9 to input the Debounce value as desired and then press key ENT to save Debounce value into memory of ET-CNT6P3 after we have already got the desired 2 digits number. When it has already saved, it will skip over to the next step immediately; however, user can press key Esc to return to the previous step.

2.7 After we have already set Debounce value, it enters to the procedure of setting Alarm value and the screen displays result as “[A][l][r][m][-][?]”. The meaning of this Alarm value is the setting operation of Output Relay when Counter reaches the Target or the required value that set to be Target. There are 4 types of generating Alarm value as follows;

- ALARM-0 (Not Alarm): It means that no any Alarm.
- ALARM-1 (Alarm & Auto Reset): It means that when Counter reaches the required Target, it will Reset Counter and automatically start counting the new Preset value again; moreover, Alarm happens for 2 seconds and then stops.
- ALARM-2 (Alarm & Continue): It means that when Counter reaches the required Target, Alarm happens for 2 seconds and then stops. If there is more Input Counter, the Counter continues

counting value. This Alarm type is suitable for notifying employee to know that the required target of production is complete. For example, if an employee must control many machines to make products in the same time; moreover, the employee must take care of them and alternate containers to catch products from machines, must set Target value equal to the amount of products are almost full the container and then set Alarm value to be 2. If the machine reaches the target of production, Alarm will happen for 2 seconds to notify the employee to know and change the new container.

- ALARM-3 (Alarm & Hold): It means that when Counter reaches the required Target value, Alarm will happen continuously until it enters the Reset Counter. While Alarm is happening and signal Input Counter also happens, Counter still continues counting value. The Alarm will stop when Reset Counter happens. Moreover, this Alarm type may be applied to control machines by sending signal from Counter. For example, if making products by machinery and must contain 500 products into each box, we must set Target value of Counter as 500; set Alarm as 3; set Reset Counter and then run the machine. When the machine makes 500 products completely, Counter ET-CNT6P3 will send signal Alarm to notify the machine to stop running first and when the employee removes all products from the machine, can Reset Counter to start running again and signal Alarm will disappear. After this, the machine can continue making 500 products again.

When the screen displays result as “[A][l][r][m][-][?]”, press key number 0-3 to set the feature of generating Alarm as mentioned above. Press key ENT to save the Alarm value into the memory of ET-CNT6P3 after getting the desired numbers. When it has already saved the value, it will skip over to the next step instantly; however, we can press key Esc to return to the previous step.

2.8 After we have already set Alarm value, it enters the procedure of setting the format of counting value and the screen will display result as “[C][n][t][r][-][?]”.

There are 2 formats of counting value of Counter as follows;

- Cntr-0 (Count Up): It means that Counter will count up or increase value.
- Cntr-1 (Count Down): It means that Counter will count down or decrease value.

When the screen displays result as “[C][n][t][r][-][?]”, press key number 0 or 1 to configure the format of counting value of Counter as mentioned above. When getting the desired number, press key ENT to save the value into the memory of ET-CNT6P3. When it has already saved the value, it will skip over to the next step instantly that is normal Counter Mode; however, we can press key Esc to return to the previous step.

Specifications of ET-CNT6P3 in Digital Counter Mode

When we have already all Setup Counter completely, Counter will start running in Counter Mode immediately. Some specifications or the features of ET-CNT6P3 in Digital Counter Mode are mentioned in the procedure of Setup but there are more specifications as follows;

- Parameter values of ET-CNT6P3 that are set will be remained until user edits the new one. Remember, turning off and turning on ET-CNT6P3, it does not make the setup of ET-CNT6P3 changed or lost. If we edit the numeric values of the Setup but not press key ENT yet, it is ineffective until we press key ENT to confirm and save the new values into ET-CNT6P3.
- When Reset Counter happens, it makes the counting value of Counter start counting value again that is equal to required value of Preset Counter. The remainder of counting (in case of setting Prescale value in group) will be set to be new initial value or zero and Output of Alarm will be closed instantly.
- When turning off and turning on ET-CNT6P3, the counting value of Counter is still stored in the memory forever; moreover, it will continue counting the value from the lastly position before turning off. Remember, turning off and turning on ET-CNT6P3, it does not include into Reset Counter.
- Every time Counter can detect signal Input Counter, it will always send signal Output Open-Collector that is OUT(+) and OUT(-). The feature of this signal Output is Pulse that has the period as same as Input Counter.
- Every time Counter counts, it will always send the counting data to Pin TXB(-) and TXA(+) of RS232 (not send through RS232). There are 2 Packets that are sent in each time consists of the counting value of Counter or Actual Counter and value of Difference Counter.
- Zero that precedes other numbers will not be displayed on the screen. If it is all zero, it only displays zero that is the digit on the far-right; for example, if it is 000050, it only displays 50.
- Setup Parameters will only be effective on the particular Parameters; it does not make the original

Counter values changed. So, if we want to start the new counting value after the end of Setup completely, always Reset Counter.

- In the procedure of Setup, ET-CNT6P3 does not mention any Input.
- Signal Input Reset Counter must run at least 0.5 seconds, it makes Reset Counter operate.
- If using with Contact Input Counter, we should not set Debounce value as 0 because it makes counting value incorrect.
- If using with Input Counter Open-Collector or Open-Drain, we must connect Input Connector correctly; in this case, we must connect signal INPUT(+) with Collector or Drain and then connect INPUT(-) with Emitter or Source.

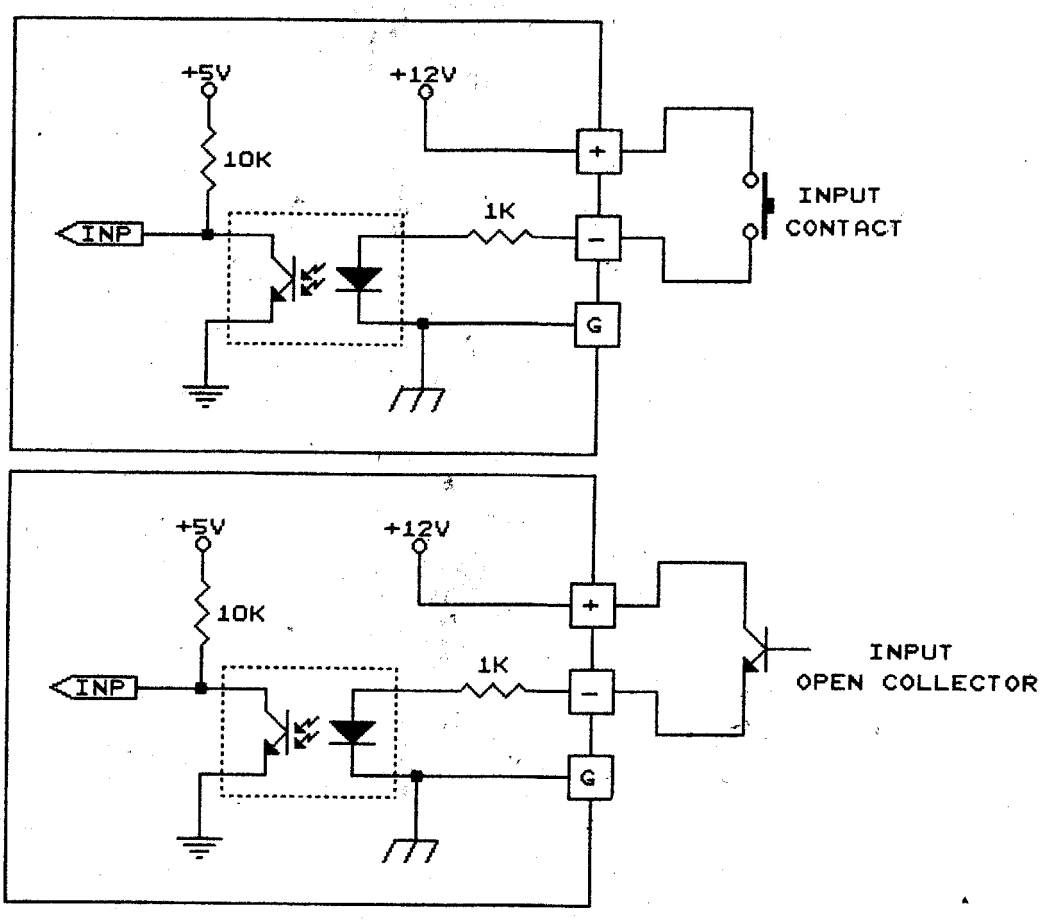

Figure displays how to connect Input Collector or Input Reset with ET-CNT6.

Transmitting data from ET-CNT6P3 while counting

While ET-CNT6P3 is resetting or counting in each time, it shows results through the screen display and always sends data to Terminal Display by signal TXB(-) and TXA(+) of RS422. This signal can be used to connect with single version ET-CNT6 that is set to be Terminal Display Mode because it can increase amount of screen display of Counter. The feature of communication and Packet data is displayed as follows;

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Baudrate      : 9600 BPS
Start Bit     : 1 Start Bit
Data Bit      : 8 Bit
Stop Bit      : 1 Stop Bit
Parity bit    : Non Parity
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The amount of data that is sent to Terminal Display in each time is 3-Packet and each Packet size is 12 Byte. Moreover, there is particular ID Code in each Packet to be divider. The meaning of ID Code in each Packet is described below;

- ID Code = 00: It is Actual Display to show the currently counting values of Counter.
- ID Code = 01: It is Target Display to show the target of production.
- ID Code = 02: It is Difference Display to show the differences between Actual Display and Target Display.

Byte 1	Byte 2-3		Byte 4	Byte 5-10						Byte 11	Byte 12
STX	ID Code		Sign	Display Code						ETX	Sum
02H	ID0	ID1	Sign	DG6	DG5	DG4	DG3	DG2	DG1	03H	Sum

The structure of data in each Packet

STX : It is 1 Byte Start of Text. Its constant value is 02H that is used to be Byte status to display the initial position of Packet data.

ID Code : It is 2 Byte ASCII Code of number 0-9 (30H-39H). It starts from Byte High first. It is used to notify Terminal Display to know that the data in this packet must be sent to which Terminal Display number in the system.

Sign : It is 1 Byte ASCII Code of number 0(30H) or 1(31H). It is used to be a sign notification of number. If Sign is 30H, it means that all 6 digit numbers in Display Code is positive value and the display is normal. On the other hand, if Sign is 31H, it means that all 6 digit numbers in Display Code is negative value and the display will be preceded by minus sign.

Display Code : It is 6 Byte ASCII Code of number 0-9 (30H-39H). It is used to display results through screen display.

ETX : It is 1 Byte End of Text. Its constant is 03H that is used to be Byte status to display the destination position of Packet data.

Sum : It is 1 Byte Checksum that is in the range of 00H-FFH. This Checksum is the total amount of data in Packet to the check whether the received data in each Packet is correct or not. For this Checksum, 00H will be XOR with the 2^{nd} Byte data (ID0) until the 11^{th} Byte data (ETX) in Packet. Receiving data in each Packet, Terminal Display will wait for receiving code 02H or Start of Text and then calculate the Checksum value of the received data from the 2^{nd} Byte to the 11^{th} Byte. Next, save the calculated values to compare with the 12^{th} Byte data that is the received Checksum. If the calculated Checksum is not corresponding with the received Checksum from the 12^{th} Byte data, it means that it receives data incorrectly, so it does not mention the data in the Packet. On the other hand, if the Checksum is correct, it will check whether the ID Code is corresponding with the

required ID Code or not. If it is correct, it will display the data.

Signals of ET-CNT6P3

ET-CNT6P3 has Connectors and Controller devices on the side of package as follows;

- AC Line is AC Cable to supply 220VAC into ET-CNT6P3.
- Fuse is used to protect circuit from short circuit.
- Switch Power is used to control ON/OFF the supplying 220VAC into ET-CNT6P3.
- Connector DB25 Female is connector for Input and Output of Counter.
- Connector DB9 Female is signal RS232 that is connected with ET-KEY232 to Setup operation mode for ET-CNT6P3 or may be connected with other devices that are signal RS232.

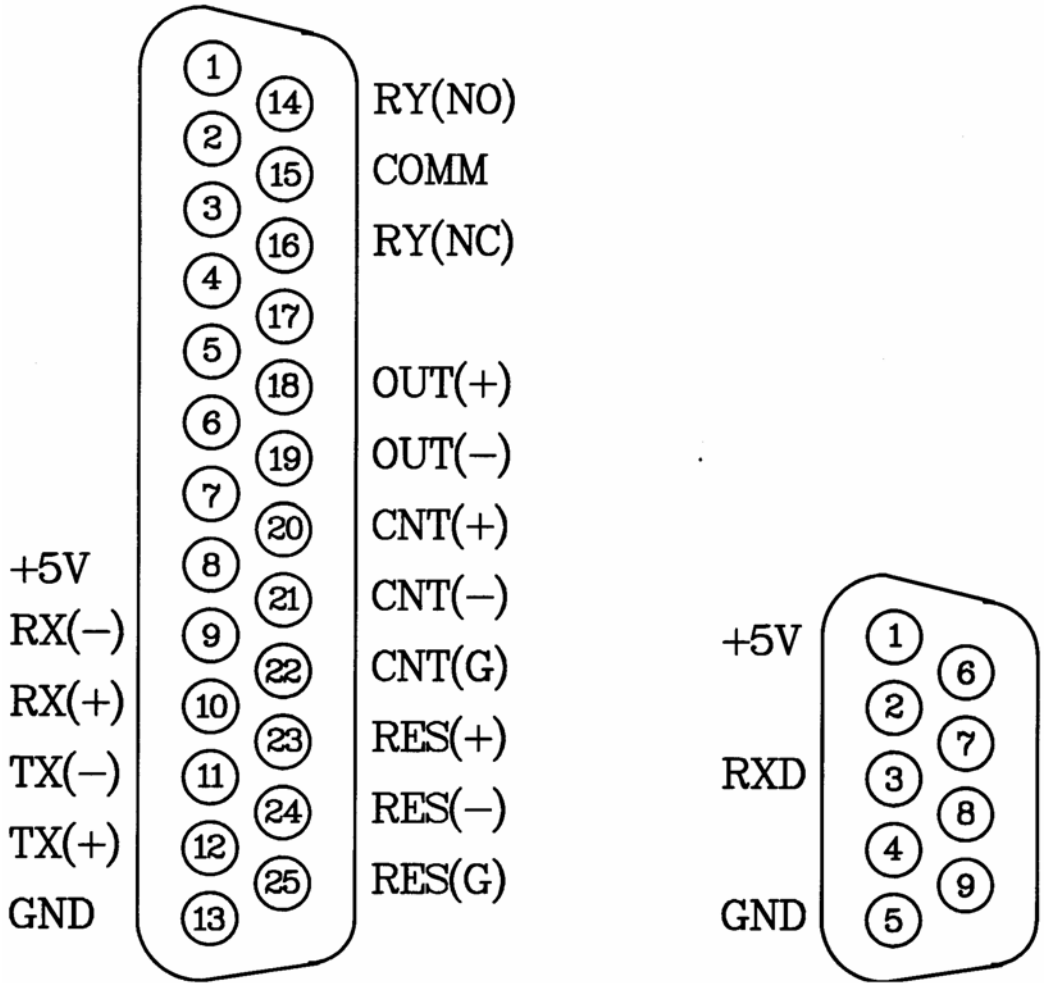

Figure displays the position of Connectors of ET-CNT6P3.

Function of signals

- +5V and GND are 5V direct current that are directly connected from power supply of ET-CNT6P3. We can use it instantly if it is necessary to use 5V direct current that does not require high current (300mA approximately). However, if we require higher current, should connect with other power supply.
- RXB(-) and RXA(+) are pin to receive and display RS422 data. Both signals are used in Terminal Display Mode or Serial Display only, except Counter Mode. We must connect signal RXB(-) and RXA(+) with signal TXB(-) and TXA(+) on the transmitter; in this case, RXB(-) must be connected with TXB(-) and RXA(+) must also be connected with TXA(+).
- TXB(-) and TXA(+) are pin to transmit RS422 data from ET-CNT6P3 to other external devices. Both signals are used in Counter Mode only. ET-CNT6P3 transmits the counting value (Actual), target of production (Target) and difference between Target and Actual of production (Difference) through signal TXB(-) and TXA(+). Every time the counting happens, we must connect signal TXB(-) and TXA(+) with signal RXB(-) and RXA(+) of the other devices such as other single version ET-CNT6 that is configure operation mode to be Terminal Display Mode to display results as mentioned above.
- RELAY-NO, COMMON and RELAY-NC is the contact of Alarm Relay that is controlled by Output Alarm from ET-CNT6P3. Moreover, it can be used as Contact Switch to connect with electric equipments such as electric light bulb, electric bell or Buzzer. This Contact can be connected with both AC and DC but it can be used with AC LOAD that is not higher than 10A/240VAC.
- OUT(+) and OUT(-) are signal Counter Output that is Open-Collector from ET-CNT6P3. It runs if it can detect signal Input Counter and stops running if signal Input Counter run out of. We can connect this signal Output Counter with Input Counter of the other ET-CNT6P3, so many Counter can count signal Input from the same point without any problem. In this case, we must connect OUT(+) with CNT(+) and then connect OUT(-) with CNT(-) of the other ET-CNT6P3. When signal Input Counter happens in each time, it makes every ET-CNT6P3 count values simultaneously from only one Input Counter.

- CNT(+), CNT(-) and CNT(G) are signal Input that is used to control counting of Counter. It can be connected with signals that are Contact or Open-Collector and signal Voltage(+12V Pulse). We must set Debounce value of signal Input corresponding with type of signal Input that is actually connected with ET-CNT6P3. If using with signal Voltage (+12V Pulse) or Open-Collection, we always set Debounce value as zero; on the other hand, if using with signal Contact Input, we should set Debounce value as 5-10 mS approximately.
- RES(+), RES(-) and RES(G) are signal Input to control Reset of Counter. It can be connected with both signals that are Contact or Open-Collector and signal Voltage (+12V Pulse). This signal RESET must be happens at least 0.5 seconds to reset the counting of Counter. If the signal RESET happens in short time (less than 0.5 seconds), it can not reset the counting of Counter.

There are 2 sets of signal Input of Counter; COUNT and RESET. Each set consists of 3 signals; Input(+), Input(-) and Input(G). In this case, there are 2 Signal Input that can be connected with Counter; Contact Input or Open-Collector and Input Voltage (+12V Pulse).

- If it is Contact Input or Open-Collector, use Input that is a pair of (+) and (-). If the contact is closed (Short), it makes both signals Input short circuit and signal Input runs; on the other hand, if the contact is opened (Open), Input does not work. For signal (G), it does not connect with anything.
- If it is Input Voltage (+12V Pulse), use Input that is a pair of (-) and (G). In this case, we must connect +12V voltage with (-) and then connect GND of +12V with (G). If Input(-) receives +12V, it makes Input run; on the other hand, if Input(-) receives 0V, it makes Input not run. For signal (+), it does not connect with anything.

Specification

Operating Voltage Supply	: 220VAC/50Hz
No of Digit Display	: 6 Digit of 7-Segment
Display Type	: LED 7-Segment (Dot LED 5mm. Super-Bright)
No of Input Signal	: 2 Input (1 Signal Counter & 1 Reset Counter)
Input Signal Counter Type	: Contact Switch, Open-Collector or +12V Pulse Signal
Input Reset Counter Type	: Contact Switch, open Collector or +12V Pulse Signal
Counter Speed	: 10-CPS (10Hz)
No of Output Signal	: 2 Output (1 Counter Output & 1 Alarm Output)
Output Counter Type	: Open Collector (Maximum Voltage +24V)
Output Alarm Type	: Relay Contact 10A/250VAC (NO-COMMON-NC)
Battery Backup Time	: 2 Year Data Backup
Operation Mode	: 4 Mode Programmable Operation : Display Self-Test Mode : Digital Counter Mode : Terminal Display Mode (RS422) : Serial Display Mode (RS232)
Programmable Mode Device	: ET-KEY232(Keyboard RS232) BOX : Computer PC with RS232 Cable + Software
Display Dimension (W x L)	: 11.5 x 52.5 cm (4.5 x 20.6 Inch)
Box Dimension (W x L x D)	: 51 x 76 x 7 cm (20 x 30.3 x 2.7 Inch)