USER MANUAL

Ctek TB2000

Automation Demonstration & Prototyping System

Ctek – Things That Move Data

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Introduction

Ctek's TB2000 Automation Demonstration and Prototyping System is a complete self-contained platform upon which automation applications can be developed, debugged, and demonstrated. Packaged in a rugged waterproof carrying case the system provides power, analog and digital I/O, motors, relays and DIN mounted interconnection blocks. Automation applications may be wired electrically on the system and mechanized using a Ctek SkyRouter with the Automation Controller application installed.

Components

The system consists of the following components:

Quantity	Component	Application
1	Power Supply 24 VDC	System and auxiliary power for all installed components
1	Z1201 I/O Module	8 multi-function inputs and 8 digital outputs
1	Buzzer	Audible output device
8	SPST Switches	Digital Inputs
5	Momentary switches	Pulse or momentary inputs
2	Potentiometers	Variable analog inputs
2	Fan/motors	Output load simulation
2	Volt meters	Monitoring variable analog inputs
8	LED Indicators	Digital Outputs
4	SPST Relays	Interposing relays for output loads such as motors
47	Interconnecting Blocks	Connecting inputs to stimulus, and outputs to loads

Electrical and Interconnection

Electrical

- SPST switches 1 – 8 are pulled up to 24 VDC when open and grounded when closed - Switches are open when down
- I/O Module Inputs 7 – 8 are open for analog, pulse, or external pull-down circuits
- Potentiometers are connected between 5 VDC and ground with the center tap providing a variable voltage

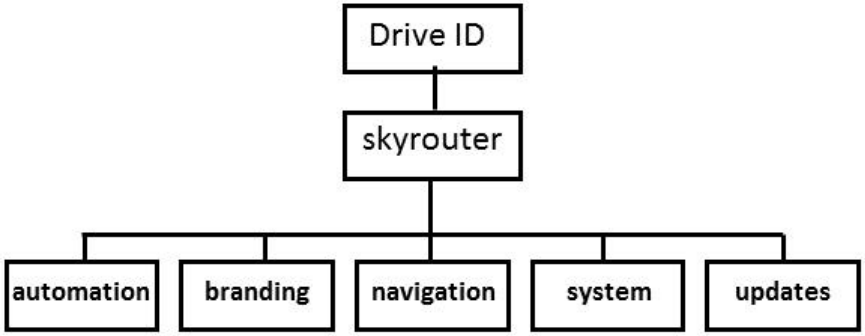
Interconnection

Pin or Device	Connected To
Output 1	Relay K1 - Coil
Output 2	Relay K2 – Coil
Relay K1 – Contact	Motor/Fan 1
Relay K2 – Contact	Motor/Fan 2
Relay K3 – Contact[1]	Buzzer coil
Relay K4	Unused - Spare
Potentiometer VR1	Input 8
Potentiometer VR2	Unused - Spare
SW1 – SW6	Inputs 1- 6 respectively
Outputs 3 - 8	LEDs 1 – 6 respectively
Z1201 I/O Module pull-up switches 1 - 6	Closed
Z1201 I/O Module pull-up switches 7, 8	Open
Z1201 I/O Module pull-up switch 9	Unused
Z1201 I/O Module pull-up switch 10	Closed
[1] K3 Contact is wired to buzzer but K3 coil is not connected. To connect use one of outputs 3 - 8	

Sample Programs

Sample programs are available as a download from http://suport.ctekproducts.com. They can be installed on a USB thumb drive by copying the downloaded zip file to a thumb drive and extracting it in place. The hierarchy created should look like:

Note – Installing the sample programs zip file on a thumb drive will overwrite any existing SkyRouter Backup/Restore files.



Once the sample programs are installed on a thumb drive, they can be loaded into the Automation Control application using the Backup/Restore utility found under Tools on the SkyRouter main menu.

Configuration Name – *Null*

Null erases all Automation configuration settings.
Clue #1 – This is easier than manually disabling each input and output and deleting each program and formula. Clues #2 – To make things even easier build yourself a back-up file of an Automation configuration in which only the Unit Configuration screen is populated. With these two programs, you can null out everything, quickly restore the unit configuration, and then get on with whatever you want to build.

Note – See Electrical and Interconnection section above for details on what these programs are doing electrically.

Configuration Name - *Set_Out_3*

The configuration *Set_Out_3* uses switch 1 as a digital input into Pin 1 of the I/O module. When switch 1 is on program O3_toggle runs and turns on LED 1 by setting output 3 to the value of input 1which is switch 1. When switch 1 is off program O3_toggle runs and turns off LED 1 by again setting output 3 to the value of switch 1.

Program O3_toggle consists of:

Line 1 – Digital I/-Set with the arguments o 3 i 1 [output pin, pin 3, use input pin value, input pin 1]

Configuration Name - *Set_Out_3_User*

The configuration *Set_Out_3_User* achieves the same result as *Set_Out_3* but uses user defined values rather than the value of switch to control the LED. *Set_Out_3* also uses switch 1 as a digital input into Pin 1. When switch 1 is on, program O3_ON runs and turns on LED 1 by setting output 3 to the user defined value of 1. When switch 1 is off program O3_OFF runs and turns off LED 1 by setting output 3 to the user defined value of 0.

Program O3_ON consists of:

Line 1 – Digital I/-Set with the arguments o 3 u 1 [output pin, pin 3, user defined value, value= 1]

Program O3_OFF consists of:

Line 1 – Digital I/-Set with the arguments o 3 u 0 [output pin, pin 3, user defined value, value= 0]

Configuration Name – *Analog Thresholds*

The configuration *Analog Thresholds* simulates the measurement of a low pressure blower such as might be found in an emergency ventilation system. Potentiometer VR1 on input 8 simulates the increasing/decreasing pressure and LEDs 1, 2, and 3 indicate pressure levels. The LEDs are driven by outputs 3, 4, and 5 respectively. The thresholds are set such that at LED 1 lights at 11 PSI, LED 2 at 18 PSI, and LED 3 at 25 PSI. As pressure decreases LED 3 goes out at 23 PSI, LED 2 goes out at 16 PSI, and LED 3 goes out at 9 PSI.

Configuration Name – *2Pump_CC*

This configuration demonstrates the **Motor Group Control** function. Motor Group Control is a built-in Automation Control application that manages between 1 and 4 motors (pumps, fans, etc.) while providing the following capabilities.

- Demand based motor start/stop
- Wear leveling – alternate motor usage for each start

- Built-in hour meters for each motor
- Monitors in/out of service inputs for each motor and adjusts alternate start-up pattern based on motors in service

The 2Pump_CC configuration also updates a SkyCloud pin if the unit has registered on SkyCloud.
In the supplied configuration SW1 and SW2 take their respective motors in and out of service, SW3 simulates a power fail, and potentiometer VR1 controls the well level at which pump1, and if needed pump 2 come on.

Configuration Name – *Timer-Counter_FF*

This configuration demonstrates the Timer/Counter function and a simple interaction with numeric thresholds. Using the Start Counters SW button on the control panel, timer/counter #1 on Input 1 is started, and LEDs 1 & 2 are turned off. Timer/counter #1 counts up to 11 where it encounters a threshold setting. The threshold setting of 11 on output 1 causes LED 1 to be illuminated and timer/counter #2 (pin 2) to start. Timer/counter #2 also counts to 11 where it encounters a threshold. When the timer/counter 2 threshold is reached LED 2 is illuminated, LED 1 is turned off, and timer/counter #1 is started over, thus repeating the cycle. This entire process repeats until the Start Output is used to turn it off.
The Clear button turns off both LEDs and stops both timers.

Configuration Name – *Clock_At_Analog_Rate*

This configuration demonstrates the timer/clock function. LED1 is turned on and off at a rate determined by the timer/clock function running on input pin 1. The rate at which pin 1 generates a square wave (clock) is a function of the numeric value set by potentiometer VR1 through analog input 16. Using the standard TB2000 configuration the rate should vary between about 2.0 seconds (2.0 on/2.0 off) and about 10.0 seconds. To observe the variability of the clock rate the clock has to be stopped and restarted between each adjustment so that the timer/clock function will reload its rate value.

Configuration Name – *Pulse Flow Meter*

This configuration builds on the previous analog rate clock by using the clock input as a pulse generator to drive a pulse physical input and simulate a flow meter. As with the previous example, the clock must be stopped and restarted to adjust to a rate change.

NOTE: This example differs from the previous example inasmuch as physical output 16 is now wired to physical input 14, which is configured as a pulse input. Be sure to verify this set up change from the standard TB2000 configuration.

Configuration Name – *Prop_Sync*

NOTE: - Before this configuration can be used the seventh input pin must be connected to potentiometer VR2.

The Prop_Sync configuration simulates a control mechanism to synchronize two rotating shafts within ± 25 rpms. The control panel displays the rpms of each shaft, the difference (delta speed) between shafts, an in/out of sync indicator (LED 1), a synchronization alarm indicator, and the state of an Alarm/Silent input used to suppress alarms.
If the unit under test is configured to use SkyCloud its pin color will be switched between red and green based on the synchronization status. The units pin on the SkyCloud presentation will also have an attribute that is assigned either a Sync or Out of sync status from virtual input pin #2.

Note also virtual numeric input pin 1 demonstrates a situation where the use of edge-triggered thresholds is required. As an example, if the delta value were 70 rmp and level sensitive triggering was in use the value 70 would satisfy both the ***Greater than -25 (Set Sync Indicator)*** condition and the ***Greater than +25 (Reset Sync Indicator)*** condition, thereby creating a dichotomy. Level sensitive triggering is a state or condition that exists once a threshold is satisfied and remains until the thresholds reset value is detected. Edge triggering on the other hand is a momentary event that occurs as the result of a threshold being crossed in the proper direction, i.e. Greater than edge sensitive, Less than edge sensitive.

Interconnection Blocks with Color Coding